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Contents

PAGE

Editorials:
Government Aid to Mining..... 103
Michigan Mine Inspection..... 103
The Situation in Spelter..... 104
Economies in Iron Making..... 104
Metallics—By the Way..... 105
Tightner Mines Co., California..... 106
La Rose and Nipissing..... 106
Racial Distribution in Western Smelteries..... 106
Correspondence and Discussion:
A Government Ore Testing Mill....Steel Arch Supports in Tunnels....Taxation of Mineral Rights in Michigan..... 107
Details of Practical Mining:
*Guards at Shaft Stations....Reinforced Concrete in a Tunnel....*Device for Splitting Pulp Samples....*Calumet & Hecla Ore Cars....*A Temporary Scaffold....Electric Pumping Machinery....*An Automatic Tailing Sampler....Filing Engineering Notes....*Storing Iron and Rails..... 109
Notes on Pyritic Smelting. George A. Guess 113
International Atomic Weights..... 117
American Chemical Society..... 118
Inspiration Consolidated Copper Co. 118
November Operations at Goldfield Consolidated..... 118
The Miami District, Arizona. W. R. Ingalls 119
Bat Guano..... 122
Zinc Dust in 1911..William J. Dwyer 122
Mining in Great Britain in 1911. Edward Skewes 123
The Mining Industry in Germany. O. H. Hahn 124
Mining in Jalisco in 1911. Austin C. Brady 125
The Cyanide Industry. William J. Dwyer 126
Molybdenum in 1911..... 126
Igneous Concentration of Zinc Ore. F. L. Clerc 127
Analysis of Commercial Tin..... 131
Data on the World's Principal Mines. S. F. Shaw 132
London Tin Market in 1911..... 135
Personal, Obituary and Societies... 136
Editorial Correspondence..... 137
Mining News..... 139
Markets..... 145
*Illustrated.

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Government Aid to Mining

A determined effort is being made in certain quarters to induce the Federal Government to mix paternally to a further extent in the mining industry. A mass meeting was recently held in Denver, at which resolutions were adopted, petitioning Congress for an "experiment station . . . . . at which all metalliferous ores may be analyzed and at which all known processes of ore treatment may be applied, and at which new methods and processes may be developed and perfected."

Our friends who promoted this meeting will forgive us, we hope, if we express some amusement over it. The keynote was practicality, and the glorification of the "practical man" was duly sounded. One speaker expressed his approval of the work the scientist is doing, but remarked that the practical miner should be the principal speaker and should be in control of the meeting. A Denver correspondent writes, however, that the time of the meeting was so consumed by the presentation of papers by young men of no particular renown and college professors, that the "practical men" had no chance, which perhaps is merely one more example of the difference between preaching and practicing.

The right or function of the U. S. Bureau of Mines to undertake such an enterprise as that now proposed, is not at present under discussion. Authorization is sought by direct action of Congress; and Congress has the right to appropriate the money of the people in any way it sees fit, providing it be constitutional. The question is merely, therefore, what good would there be in the proposed adventure?

The main idea of the Denver meeting was echoed in the words of a local newspaper reporting it, that "if the government experiments evolve a process for handling ores running below $10 per ton, thousands of mines would be opened in Colorado." We might take exception to the figures, but in substance it is undeniably true, i.e., ability to beneficiate profitably a lower grade of ore would, undoubtedly, promote mining activity.

But what have the despised scientists been doing in all the years? Is it merely a dream that they have developed the cyanide process, the multifold improvements in methods of mechanical concentration, blast-roasting, basic converting, and the whole gamut of advances in the art that have enabled the profitable treatment of gold, copper and lead ores, whereof the total metallic value in the refined state in the market is much less than $10 per ton?

When the Denver meeting said that "In mining as in agriculture, from the very nature of the enterprise, there is and can be but very little coöperation involving the problems of the industry," it made itself ridiculous, not merely by spurning what the engineering profession has done, but also by implying that the Federal Government can improve what private persons ought to do (and, in fact, have done), out of mere self-interest. Does anyone in possession of his senses suppose that our engineers and chemists and our mining and metallurgical corporations, with ample funds and facilities at their disposal, are not going to develop the cheapest possible methods of ore treatment, and does anybody imagine that the government with such talent as it could command with $100,000 working capital could solve problems in which the whole industry has heretofore failed?

Michigan Mine Inspection

Beginning next fall, mine inspectors in Michigan are to be elected by popular vote, a law to that effect having been enacted at the last session of the legislature. This is a step backward. Mine inspectors should be appointed, not elected. This is not merely our opinion. It is that of most mining engineers, operating, inspecting and consulting. The Mining and Metallurgical

Society of America expressed itself that way, with only one dissenting vote, when this question was considered by it last fall. State mine inspectors are by creation and in effect a species of policeman. To elect them is as unwise as it would be to elect municipal policemen.

The Situation in Spelter

The statistics published last week threw much light upon a situation that had previously been obscure, but there still remain some highly puzzling features. Thus, while iron and copper, the metals with which spelter is most closely linked in the arts, showed decreased consumption in 1911, spelter experienced on the face of the statistics a phenomenal increase in delivery, if not in consumption. It is imposible to believe that the quantity of spelter delivered in 1911 was actually consumed. There is no reason to believe that there are any concealed speculative stocks. The inference is, therefore, that consumers overbought during the second half of the year, i.e., accumulated a surplus of stock in their yards against future requirements.

The supply of zinc ore during 1911 was bountiful, wherefore the unusually large margin enjoyed by the smelters. The large production of spelter in 1911 was rendered possible by important additions to smelting capacity. Further large additions are shortly to become available. There being no dearth of ore, the effect of these additions will be inevitably to increase the supply of spelter in 1912, and the outlook is distinctly that this will find a market only at a lower level, although, of course, so long as the European market remains strong the American market cannot fall below its parity and the situation in Europe seems likely to be a firm basis for the market here.

The statistics showed the stock of spelter on Dec. 31 to be unusually low. If the statistics were confined to unsold spelter alone, the quantity available would be practically *nil*, the small quantity reported by the respective smelters being in fact generally sold, but enumerated as stock on hand because the accounting included everything still at the works. With the market thus bare of supplies, and the January output being so nearly sold, belated buyers have again found themselves compelled to pay higher prices. On the other hand, but few consumers seem eager to make contracts for later spelter, evidently considering that when the time comes they will be able to buy it more cheaply. Until the time comes when the smelters have again accumulated a reasonable working stock, the spelter market will be dangerous.

Economies in Iron Making

One of the gains attendant on periods of comparative dullness in the steel trade is that it gives a breathing space in which some attention can be given to improvements in manufacture; further, that it enforces attention to possible economies. It is not meant by this that all improvements were neglected in the construction of the mills at Gary and Allequippa or the other new plants that were the outcome of the boom of 1906-7. Many advances were made, indeed, but the tendency in their design was rather towards intensive production, to increasing the productive power of the working unit, than to securing what may have appeared minor economies. We are ahead of our German and British competitors in the rate of production; but we are behind them, especially the Germans, in economy of working, the saving of byproducts and the devising of possible uses for waste material.

The last year or two has seen some advances made in this direction, among the more notable being the extensive use of blast-furnace slags in the making of cement. A great increase in this use of slag has been made, notably in the works of the Steel Corporation. There are large quantities of slag made, however, which are not suitable for cement; and we have done little in the way of making the slag bricks which are so largely used abroad, or in applying slag in the making of the good roads which are so much needed in this country. There are other uses to which this waste product may be applied which are hardly touched as yet. The use of basic slag in the making of fertilizers, where its phosphoric-acid contents are of value, is hardly known here, though it is common in Germany.

The use of the waste gases of blast furnaces in producing power has made considerable progress in this country. Its extensive application is one of the features of the Gary plant. The use of the byproduct oven in making coke for iron production makes slow progress, however, even allowing for the large plant now being erected at Bethlehem. By far the larger part of our coke is still made in the old beehive oven, without an effort to save or use the gases, to say nothing of the other byproducts. Dr. Douglas referred years ago to the enormous waste of gas in the Connellsville region, for instance; but it still goes on with very little diminution.

The demonstrated economies of the Gayley process of drying blast have not secured its introduction as widely as might be expected. Only a few installations are as yet reported in use. The success of those now operating has not sufficed to bring about the building of others, and there is still plenty of room in this direction for securing economies in production.

Other lines might be mentioned in which there is much room for improvement. The comparative lull in the iron trade and the lower range of prices to which we seem to have settled down may give time and inducement to work out improvements and economies; and in some degree these conditions may be in the end a benefit to the industry.

Discussion of the prices of Lake iron ores for the coming season has hardly yet begun, so that the furnaces which have to buy their ore are yet in the dark as to the effect that the reduction of rates on the Minnesota roads will have. Sellers are holding back, and the season prices will probably depend a good deal on the developments in the iron trade for the next two months. Iron-ore prices are not nearly as important as they used to be, since they affect less than a quarter of the Lake ore shipped; but they mean a good deal to the still important class of merchant furnaces west of the Alleghenies.

The existence of large stocks of silver in Bombay and Shanghai at the close of the year does not seem to disturb the Indian-Chinese syndicate, which has had so much influence in the market for two years past. Notwithstanding many London predictions, the syndicate has seemed —and still seems—able to carry the load. The recent speculative squeeze in London has passed over, spot and future prices resuming nearly their normal relation. The price of the metal is still maintained, however, at nearly the high point which it reached in November and December; and no immediate change seems probable.

Metallics

At the amygdaloid mills of the Quincy Mining Co., in the Lake Superior copper district, the water consumption is in the ratio of 24 tons of water to one of rock. The average copper content of the finished "mineral" is about 70 per cent.

The Coslettizing process for producing a rust-proof finish on iron consists in boiling the article in a solution of 1 oz. of iron filings and 4 oz. of phosphoric acid in 1 gal. of water. The coating produced is black and if the work be carefully done no undissolved iron filings will appear on the finished surface.

At the Talisman mine, Karangahake, N. Z., a water jet is used during drilling. The supply is taken from the main pump column and the pressure varies up to 140 lb. per sq.in. At blasting time a $\frac{3}{16}$-in. nozzle is screwed to the end of the compressed-air pipe and air is allowed to blow through as soon as the fuses are lighted. This air rapidly dissipates the powder fumes.

In sintering experiments with iron-ore fines in a straight-line Dwight & Lloyd machine, it was found that the cohesiveness of the product varied inversely with the amount of the internal shrinkage of the mass. In sintering Cuban (Mayari) ore with fuel, no advantage was found in using over 7.5% coal or coke, nor were the results from coke any better than from coal.

The yield of salt from the evaporating ponds using water from the Great Salt Lake in Utah is usually from 250 to 300 tons per acre; from the French Atlantic fields the yield from sea water is from 0.6 to 11.1 tons per acre; in the French Mediterranean fields, 12.1 to 23.7 tons; and from the Corsican fields about 68 tons per acre. The water of Great Salt Lake is about five times as salty as that of the Atlantic Ocean, having a specific gravity varying between 1.11 and 1.17 and containing from 15 to 22% of solids; at a specific gravity of 1.15 it contains about 238 grams of solids per liter.

A spad or spud is a sharp-pointed, flattened piece of metal, with a small hole through the broad end; it is used in underground surveying and is placed in a wooden plug, the latter being first driven into a shallow drill hole. In placing the spad in the plug, care should be taken to have the broad side at right angles to the line of sight; in other words, the line of sight should look through the hole. By so doing, the chance for error due to moving of the spad by accident is minimized, as the plumb line hanging from the hole is subject to less lateral deviation from the true line than if the spad were placed so that the line of sight is directed toward the thin edge of the spad.

By the Way

It is pointed out in Ishpeming, Mich., that the Oliver Iron Mining Co.'s tax of $100,995 on mines in that city, amounts to 40c. per ton on the ore shipped last season; the Cleveland-Cliffs Iron Co.'s tax of $125,540 amounts to 26c. per ton; the Jones & Laughlin Co.'s tax of $11,-604, 5c. per ton.

Albert Freeman, Julian Hawthorne, Josiah Quincy and others were taken before Judge Hough for pleading on Jan. 5 under an indictment for fraudulent use of the mails found by the Federal Grand Jury on Dec. 28, 1911. Freeman was held under $25,000 bail, and the others under $10,000 each. The indictments were found in connection with the selling of stock in the Temagami-Cobalt, Montreal-James, Hawthorne Silver & Iron Mines, and other operations. The JOURNAL has in the past made adverse remarks about the Temagami-Cobalt and Hawthorne promotions upon several occasions. Freeman has been in the background in these recent operations; before them he was engaged in the King Solomon Gold Mining Co. and the United Mining Company.

An official circular announces that the beautiful new resource map of Utah, prepared by the State Conservation Commission, is now ready for distribution. This is by far the most complete and elaborate map of the state that has ever been prepared. It has been drawn to a large scale—a sixth of an inch to the mile—and is 54x78 in. in size; mounted on cloth with rollers top and bottom, ready to hang. It shows the U. S. survey lines, including "off sets," the correct location of the cities, towns, county-boundary lines, railroads, principal and secondary wagon roads, canals, reservoirs, lakes, streams, land boundary districts, experiment stations, coal beds, outcrops, iron-ore deposits, hydrocarbon veins, forest reserves, mining districts, mountains and peaks, valleys, electric-power plants, etc. . . It will be a necessity for the homeseeker, the surveyor and the person who wants accurate, trustworthy information about the geography and natural resources of the state. . . In order to help defray the expenses incurred in the preparation of the map, the commission has found it necessary to make a charge of $5 per copy—a price that is said to be considerably less than cost. The circular further announces that the requests for the map now on file at the office of the commission, 214 Felt Building, Salt Lake City, indicate that the map will have a ready sale and that the supply will not last long. Utah homeseekers and surveyors must be "in bonanza" to be thus tumbling over themselves to hand out $5 gold pieces, when all the rest of the world and his wife are endeavoring to recover from the financial shock of Christmas shopping and other end-of-the-year expenses. We have the word of a local humorist that a large number of people at this time are busily engaged in trying to make up the difference between the deficit and the liabilities. Those who are in a financial subway will have to forego the pleasure of this valuable map and continue to patronize the more modest but excellent maps of the U. S. Geological Survey.

The Lake copper country is already feeling the effect of 14c. copper. According to a local gazette, a pioneer in the jewelry business in the copper country stated, on Dec. 24, that he was having the best business he ever had at that season of the year. The cumulative effect of an impending rise in copper has also been manifest, for the local scribe continues: "Whether it is due to the rise of copper is impossible to say, but the marriage rate has increased wonderfully during the month of December. There have already been a dozen or more weddings of Calumet people this month and a good half dozen are scheduled for the coming week, while there will be a few more right after the first of the year. It is rather odd to note, too, that the stork has been increasing the number of his visits to Calumet homes the last week or so, and Township Clerk George Martin said yesterday that he looks for a 'pretty good month' in birth registrations in December." And copper may go to 15c. Dealers in teething rings would better place additional orders at once.

Berton Braley contributed the following "pome" to the New York *Times*. If you have never worked underground, or if "po'tree" does not appeal to you, don't read it.

BILL AND THE SUPE

Now listen to me, while I tells to you,
The tale of the Supe an' Bill McGrue.
Bill he was takin' a little mope
After drillin' his holes in the stuffy stope,

An' settin' down on a timber car
He lights a match to a bum cigar.
He scurcely more than gits a light
When a guy in overalls heaves in sight.
"Takin' a rest?" says he to Bill.
"You bet," says William, an' sets right still.

"Ain't you got nothin' at all to do?"
"I have," says Bill, "when I'm ready to."
"What would you do," says the stranger guy,
"If the shift boss happened to wander by?"

"I'd set," says Bill, "like a tired bloke,
An' take my time fer my rest an' smoke."
"Do you know," says the stranger, "who I am?"
"I don't," says William, "nor care a damn!"

"Well, I am the Superintendent here!"
Bill's grin extended from ear to ear.
"The Supe," he says, "of the hull big mine?
That's bully," he says, "that's grand, that's fine;

A mighty good job fer a man to git,
If I was you I would tend to it!"
Then Bill leans back on the empty car
An' goes on smokin' his bum cigar.

* * * *

Tightner Mines Company, California

SAN FRANCISCO CORRESPONDENCE

The organization of the Tightner Mines Co. to develop the Tightner and Red Star mines in Sierra County, Calif., will have a direct and positive effect on the development of the entire Alleghany district. The prospecting of these properties by J. M. O'Brien, of San Francisco, under an option of purchase, disclosed sufficient orebodies to induce the installation of a 10-stamp mill to continue the exploration. The mill had been in operation only long enough to make test runs which were apparently satisfactory and prompted the company organization and incorporation. A feature of the undertaking, indicating the strong belief that the Tightner and Red Star will develop into a large producer, is that the capital stock is placed at the low sum of $100,000, divided into only 100 shares, none of which will be put on the market, and a considerable proportion of which has been subscribed for by men connected with the North Star mines and other prominent properties in Nevada County.

The Tightner has for some time been known as a specimen mine, rich in free gold-bearing quartz, some of which was so rich that continuity of the ore even of ordinary grade was doubted. H. L. Johnson, the owner, did not mine the claim; he merely took out the rich deposits wherever found and seemed satisfied with the returns which made a competence. In other words, the owner gouged his own mine; and did it in an unminerlike manner, regardless of economic and practical development. The recent explorations have gone beyond the rich deposits and to the exploring of the vein in search for a continuous orebody; this policy will, of course, be pursued in future development by the present company, to which the purchase bond has been assigned. The Alleghany district has for many years been worked chiefly by men and companies unable or unwilling to invest the necessary means for thorough exploration, except in the case of the Plumbago, which has been operated for years by practical men. Many of the owners of claims are men of small means or dependent on the output of their properties for subsistence, and have been greatly handicapped by the long winter seasons necessitating the laying in of six months' supplies, which must be wagon-hauled from Nevada City, a distance of 30 miles over a heavy grade. Besides this, freight for Nevada and Sierra Counties must be transferred from the standard-gage road of the Southern Pacific at Colfax, to the narrow-gage road to Nevada City and Grass Valley, the terminal points. So mining in the Alleghany and other districts of Sierra and northern Nevada Counties is an expensive undertaking, and not inviting to investors, notwithstanding the generally high grade and large deposits of the ores.

The successful development and operation of the Tightner mines may not induce railroad construction but it should attract the investment of capital sufficient to put Sierra County on the map as a present-day producer, as it was in the early days of hydraulic and drift mining and the still earlier days of the pan and rocker. In the last 15 years there has been a larger investment of faith than money in the Alleghany and some other districts of Sierra County.

Abraham Hall, of Grass Valley, is manager of the Tightner Mines Co., and Lawrence Wagner is assistant manager and acting superintendent at the mines. Charles C. Derby, of Nevada City, is consulting engineer. Mr. Derby, as engineer in charge, and Lawrence Wagner, as consulting engineer, made the examination and conducted the preliminary exploration of the Tightner and Red Star and advised the purchase of the property. The following are shareholders in the company: A. D. Foote, manager, and A. B. Foote, assistant manager of the North Star at Grass Valley; C. E. Clinch, Abraham Hall, Robert Bedford, Carl P. Jones, of Grass Valley; Edward Uren, George Scarfe, John Rector, Charles C. Derby, W. H. Martin, of Nevada City; J. M. O'Brien, of San Francisco.

La Rose and Nipissing

COBALT CORRESPONDENCE

The two large Cobalt properties, Nipissing and La Rose, have been coming in for a good deal of attention lately, the shareholders of La Rose particularly being greatly stirred up about the plans for the distribution of the cash surplus. This surplus has been steadily piling up, ever since Mr. McGibbon took charge of the affairs of the company, when he cut the dividend rate, until now the cash on hand amounts to approximately $1,500,000. Various suggestions for its distribution have been made, and it is stated that the directors are considering the investment of a part of this fund, in promising properties in other districts. This would appear to be a sensible course of procedure, but some of the shareholders, particularly those who bought in at the high prices, are greatly exercised over the matter, and demand that the surplus be divided among the stockholders in the form of a cash bonus. The property is in excellent physical condition, and the earnings are sufficient to justify an increase in the dividend rate, which will probably be made before long. Several of the directors have for some time been in favor of the increase, but they were held back by Mr. McGibbon who desired to have the company on an assured basis.

While the talk in connection with La Rose has been of an increased dividend rate, Nipissing seems to be scheduled for a cut, and it would seem as if this were probably due within the next six months. This move would not be taken, as is generally supposed, in order to provide funds for the purchase of other properties, but because the physical condition of the property is not such as would permit of the payment of the present rate for a much longer period, without a serious depletion of the ore reserves. The company now has under consideration and under way, new construction and development, that will call for an expenditure of about $400,000 and this cannot be carried on without drawing on the cash reserve, which the directors wish to keep at about $1,000,000. Nipissing has a large acreage, but that does not imply that it will all be as rich as that part which is at present being developed and, in fact, although the property has not been by any means thoroughly prospected, the limits of the mineralized areas have been more or less well defined. The company has large reserves, part of which it does not contemplate drawing on for some years to come, but recent underground developments in certain portions of the property have been disappointing. When the new mill is completed, it should earn at the rate of about $3000 per day gross, and the revenue from this will have to take the place of that lost by the falling off of the high-grade ore.

Racial Distribution in Western Smelteries

WASHINGTON CORRESPONDENCE

The U. S. Immigration Commission has prepared a review of the smelting and refining industry on the Pacific Coast and in the Rocky Mountain states which is shortly to be published. The report shows that about seven-tenths of the employees in Colorado, Montana, Utah and Arizona are of foreign birth. The foreigners include 41 distinct races but the Americans were distributed about equally throughout all the states, Utah, however, having more Americans than the other states. Mexicans are chiefly found in Arizona and Greeks in Utah. The only Japanese employees are in Utah. Southern and eastern Europeans are more generally employed in smelting establishments in Colorado and Montana than they are in the mines of those states. Americans, English or Germans hold practically all the positions as foreman and the like. The scale of wages of smeltery employees is highest in Montana and lowest in Colorado.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

A Government Ore Testing Mill

The meeting held at the statehouse in Denver, Dec. 28, 1911, had a specific object in view, *viz.* to discuss the question of asking the government to establish an experimental ore testing station in the state, and to furnish an adequate appropriation for that purpose.

Instead of adhering to this purpose, the time of the attending representative mining men, most of them of from 20 to 30 years' experience, was taken up in listening to the reading of papers by young men of no particular renown as metallurgists or mining engineers; several of the older mining men who had come there prepared for a *pro* and *con* discussion, left before the meeting was half over.

The best brains and deepest thinkers in the metallurgical fraternity, not alone in this state but in the world, are and have been for years steadily at work on the solution of the low-grade ore treatment problem, and their processes and successes have been described in all the leading technical journals. What they have done is therefore well known to the mining world, and is demonstrated by such prominent examples as Strattons' Independence of Cripple Creek, the Homestake in the Black Hills, Alaska-Treadwell at Douglas Island and the porphyry coppers in Utah, etc. When ores can be treated at a cost of about 75 to 80c. per ton, it would not appear probable that the government or its employees could make any improvement, nor would it seem that there was any excuse for calling on the government to step in with $100,000 and take business away from those firms and individual engineers who make the metallurgy of low-grade ores their life work and their living.

Even if $100,000 were so provided, this sum would be but a drop in the bucket, and if established at Silverton as seemed to be the sense of the meeting, it would be of no use to the miner and prospector about 300 miles distant in the northern part of the state.

This question also arises: If an experimental plant were installed, whom would the government place in charge? If Colorado were allowed to make the selection, five men could be named whose life experience and successes with Colorado ores have eminently fitted them for the work. Not one of these would probably accept the position for less than $20,000 per year and are therefore out of the question with only $100,000 available working capital. Young men just from college would be of no use whatever.

A second meeting is to be held and it is hoped that an open discussion will be in order and the reading of papers omitted.

MINE MANAGER.

Denver, Colo., Jan. 4, 1912.

Steel Arch Supports in Tunnels

Some of the arguments that have been advanced by the advocates of circular shafts appealed to me as being equally pertinent to drifts and tunnels in soft ground.

Timber is the material used to support soft ground. The three-piece tunnel sets are cut with the legs or posts inclined inward at the top, to obtain some of the effect of an arched support. When weight comes upon the cap of such a set the tendency is to split the legs, drive them up into the cap itself and bend the cap at the center. Weight coming on the legs tends to bend them inward and to draw them away from the cap so that the cap settles or comes nearer the floor. There is nothing to resist the pressure but the transverse strength of the timber.

The transverse strength of timber is not great compared to some other materials, and in recent years several attempts have been made to use concrete or steel instead of timber. Concrete, even though reinforced, has not proved to be satisfactory.

Steel sets are now satisfactorily employed in coal-mine entries, but in the one metal mine in which they were tried, of which I am acquainted with the results, it developed that the steel caps and legs of the straight three-piece drift set buckled under normal pressures, and the steel became so distorted as to make replacement by the old timber sets necessary.

USE OF ARCHED SUPPORTS SUGGESTED

It is not strange that straight-piece sets should become deformed, and the fact that they do suggests that a different shape of set should be used. It is my purpose to suggest a shape of steel drift support that would stand normal drift pressures without deformation; it is to use arched caps where the pressure is from the roof or closed oval shapes where the pressure comes from the sides, bottom or from all directions.

We have a good precedent for the use of arched caps in the timber segmental arches used in large railroad tunnel work and in the use of curved or circular shapes in the cast-iron segmental lining of the tunnels under the North and East Rivers, in New York.

In the case of an arched cap or stull the pressure would not only be resisted by the transverse strength of the section, but, as deformation must be accompanied by movement, the cap would have to become straight before it could sag at the center. To become straight, the pressure at the ends would become so great as to force the ends into the sides of the drift. In short, the pressure from the roof would tend to elongate the cap, or increase the distance between its ends instead of shorten them, as would be the tendency in a straight, flat cap. The pressure would be resolved into a side thrust that would be resisted by the compressive strength of the material. The pressure would be exerted upon the walls and could be distributed over a large area by using cast-iron plates for the ends of the I- or H-sections of the steel cap to butt against, wooden blocks and wedges being used between these cast-iron plates and the rock walls.

DEFORMED CAPS COULD BE RESHAPED

The wooden blocks would become crushed before the cap would be seriously deformed, and in case of deformation it would neither be a difficult nor expensive task to take down the cap and reshape it.

For side pressures the use of oval rings of I- or H-sections could be used. The drift would have to be cut a little larger and to more or less oval shape, but such increased work would not seem too great an obstacle to the use of structural-steel rings instead of three- or four-piece timber sets. Cast-iron segments as a continuous lining might also be used, but would probably be more expensive than steel oval supports for wood or rail lagging.

The question of lagging is largely one of expense. Old mine rails may be used, but for ordinary timbered drifts small timber of poor-quality wood might be utilized over steel caps or oval ring supports. It is often the case in drift timbering that poor lagging can be used with entire satisfaction if the supports are strong, which would be the case with steel. Concrete panels have been used

in coal mines to take the place of lagging, but in most places would be more expensive than timber.

A further advantage of steel supports in drifts lies in the possibility of their removal and use in another part of the mine when it is no longer necessary to keep a drift open.

CLARENCE C. SEMPLE.

New York, Jan. 8, 1912.

Taxation of Mineral Rights in Michigan

The legislature of Michigan has passed a law to tax mineral rights. The radical enforcement of this law may be a matter of considerable moment to holding companies in the upper peninsula, and the measure was fought by the various interests who retain the mineral rights on vast unexplored tracts of land on which the surface and timber may have been sold. To what extent the taxation of mineral rights of unknown value will tend, is not yet known, and it may be several years before the difficult problem of their proper valuation is solved. However, the new law becomes operative this year, and next spring the assizing officers are expected to put mineral rights on their lists in the same manner as they would real estate. The owner is required to make a sworn statement of the value, but the owner's figures do not necessarily govern the assizing officer.

RESERVATION OF MINERAL RIGHTS

Land in Michigan was formerly transferred with no mention of mineral rights as it was taken for granted that these went with the surface. However, as the value of the iron and copper ores grew more apparent, it became the custom to reserve the mineral rights when selling the surface to a farmer or settler. Hundreds of thousands of acres are held in this manner; on much of the land there is no chance of any valuable mineral being found, but the mineral right is retained because such is the custom and because thousand-to-one chances have been known to occur in the mining business. Other property on which the mineral right is held, is known to contain iron formation and would be extremely desirable land to explore.

There has been some sentiment toward forcing the owners of mineral rights to explore their holdings or to sell at a reasonable price to someone who will. The so called "curse of the mining business" relates to the long continued holding of mineral lands and the consequent tying up of the industry by remote owners who have no intention of developing their properties, and who hold out for unreasonable prices. On the other hand, several of the larger companies, such as the United States Steel Corporation and the Cleveland-Cliffs Iron Co., which have looked into the future, have secured large holdings for ore reserves which they cannot develop at the present time because their operating mines are more than furnishing sufficient ore. Such companies are usually doing all that could be expected toward development of their holdings.

LAND DIVISIBLE INTO THREE CLASSES

There would then in general be three different kinds of mineral rights to consider. One tract might lie entirely on Archean granite several miles from iron formation, and would, of course, be of practically no value. A second tract might contain iron formation or stand a good chance of so doing under a thick overburden; the owner, we will say, is the Cleveland-Cliffs Iron Co., which is holding the property until the need for ore warrants spending money to explore by diamond drill; the Cleveland-Cliffs Iron Co. is operating mines on the Marquette range and is stocking large amounts of ore that it does not need for a long time, merely to keep its organization up and to give employment to hundreds of employees. A third tract might be held by people living thousands of miles away who never saw the property, but obtained it cheaply in some transaction with a man who needed money at the time; perhaps there is a fair chance of finding ore on the property and it offers an opportunity to men in the district if moderate terms can be agreed upon with the owners. But such owners too often demand a large cash price paid down and will permit of no exploration agreement that can be touched by men of moderate means. It is to reach such owners as fall in the third class that the bill has been passed for the taxation of mineral rights.

DIFFICULTY OF VALUING UNDEVELOPED LAND

The valuation of unexplored mineral rights is a difficult problem. J. R. Finlay in his work for the Michigan Tax Commission did not attempt the problem, and has been criticized for this policy. His opinions on the valuation of undeveloped iron lands is as follows: "It was hoped, up to the completion of our investigation, that some means would be found of placing a value on unexplored iron-ore formation. The final result, however, is a disappointment. Such lands are undoubtedly valuable, but we have not succeeded in finding any logical measure of their value. If we could compare an area of fresh iron lands with another area that had been explored and had been proved to contain a certain tonnage of iron ore, we might then rationally assume that the undeveloped land would produce somewhat in the same proportion, but it has been impossible to make any such comparison. It must be borne in mind that the iron mines, as well as the copper mines, would lose value every year unless new ore is found to take the place of what is removed. It seems to me that it is a logical position to take in regard to undeveloped mineral lands, that whatever values they may be proved to contain will be appraised as soon as a mine is developed; in other words, the state loses nothing in the long run by not taxing such lands."

In the JOURNAL of Oct. 28, 1911, Edmund B. Kirby disagrees with Mr. Finlay. He says: "Value is desire expressed in cash, and whether the thing is desired for the purpose of eating it, or deriving revenue from it, or of looking at it, or gambling or swindling with it does not affect the reality of its value." This is meant to show that undeveloped mineral lands may have a high value, although bringing in no dividends or profits. He continues: "There is nothing mysterious about mining property which affects the determination of its true cash value. Many other kinds of real estate also have uncertainties as to their possible earnings and productive life. The same principles of valuation apply to mines as in the case of city lots, sawmills or quarries. A private individual has no trouble in ascertaining exactly what he will have to pay for mineral land in a given locality or on a certain formation, and why should the state have any?"

In answer to this, Heath Steele, in the JOURNAL of Nov. 11, 1911, confirms Mr. Finlay's opinion that "the true cash value of a mine is the present worth of its annual dividends (calculated as the present worth of an annuity for the estimated number of years the mine can maintain its dividend) and if the dividend period is a number of years ahead, this present value of the dividends must be deferred a like number of years." Applied to unknown mineral rights the problem becomes, "what is the present value of an X annual dividend for Y years deferred Z years? The last factor may be one or 100 years, depending upon some interested party having faith enough to undertake the development, which may never occur, and in the event development was started the first two factors are still to be determined only by experience, with a percentage in favor of proving conclusively that it has no value as a mine. The mere fact that a certain price is asked for a tract of land does not establish its true cash value; neither does an occasional sale at high prices demonstrate that the land is actually worth the money paid for it. If we were to use this rule, we would be compelled to establish the value of a mine by the prevailing stock quotations, to the absurdity of which any engineer will testify."

P. B. MCDONALD.

Negaunee, Mich., Jan. 4, 1912.

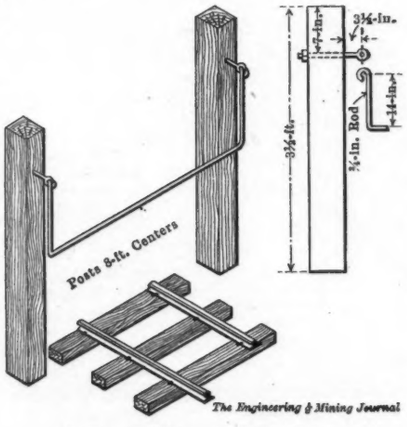
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Guards at Shaft Stations

At the stations of the inclined shafts in the Michigan copper district many different kinds of guards have been tried. At some shafts a wire rope or a light chain is used having a hook at its end



A SIMPLE IRON SHAFT GUARD

that fastens to a ring carried by a post at the hanging-wall side of the shaft. It is an unhandy device as the men have to go clear over to the foot wall, stoop down and pick up the chain each time to put it across the shaft opening. At other inclines the shaft bar that is in common use at vertical shafts has been copied. Owing to the length that this guard arm must have at the inclines, and its weight, a counterweight is sometimes arranged to make the lifting of the arm easier. A nail driven into the post that carries the stop on which the guard arm rests holds the arm out of the way, when it is raised and a car is being dumped.

A guard arm is handier than a chain, but the best form of bar for the inclined shaft stations consists of a ¾-in. iron rod that is bent at each end so as to have arms 14 in. long with eyes in them that hook into an eye-bolt that is fastened into the two posts of the fence that is built around the shaft at the station. These posts are about 3½ ft. high and the eye-bolts are placed about 7 in. from the top, and extend out from the posts about 3½ in. Therefore when the guard is turned up so that a car can be dumped into the skip it rests against the top of the posts and will not jar down easily. As soon as the car is dumped the bar is given a push so that it swings down to prevent any car from being pushed into the shaft.

Reinforced Concrete in a Tunnel

The Snake Creek drainage and working tunnel at Park City, which is being driven from Snake Creek to secure deeper drainage for the mines of the district than is at present available, and to open the Bonanza Flat section in the southern part of the camp, is now in over 4000 ft. About halfway in, some extremely bad ground was encountered, which could not be held with ordinary timbering. A system of reinforced concrete has been evolved which will be used for about 300 feet.

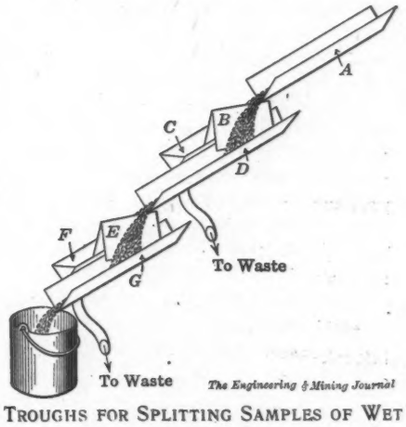
The section is egg shape with the small end down. The reinforcement consists of 50-lb. rails bent hot, in two pieces, these being set at four-foot intervals. At the top of the tunnel arch and above the rails is another rail, the whole being covered with triangular mesh screen weighing 109 lb. per hundred square feet. A shell of from 12 to 15 in. of concrete is put on the outside of the screen, and the space between the concrete and the roof filled with green quaking asp, to take up the first shock of settling ground. The tunnel has room for two tracks. It is 7 ft. high from the tracks to the center of the arch, and 9 ft. across, with a 4½x9-ft. waterway under the track; 8x8 ties are placed at four-foot intervals. About 100 ft. of reinforced concrete has been completed, and this method of holding the ground promises to be successful. Where ordinary timber was used in certain places in the tunnel it was squeezed up to a four-foot opening, so that special measures were necessary. The part completed is holding well. The work is being financed by Daly-Judge and Knight interests. The tunnel is crosscutting the formation, and is expected to reach mineral-bearing ground soon. When completed, it will be between 14,000 and 15,000 ft. long.

Device for Splitting Pulp Samples

BY FREDERICK H. HAZARD*

It has been my experience in cutting down wet samples of fine ore, such as material from dumps, tailings, sands and concentrates, to laboratory size, that the limit of accuracy was reached when the sample approached a weight of from 150 to 200 lb. Drying samples of this size for splitting is a slow and vexatious process even if facilities for so doing are at hand.

On one occasion I was called upon to sample the concentrates from a large



TROUGHS FOR SPLITTING SAMPLES OF WET PULP

number of cocoa-matting tables to determine the grade of tables and thickness of pulp necessary for best extraction and the time of operation, after cleaning, during which the matting was effective as a gold catcher. Though there was a small drier in constant operation I soon found the samples were accumulating and it was found necessary to postpone sampling frequently to prepare the samples already taken for the laboratory.

The accompanying sketch illustrates a device that eventually was resorted to for splitting these samples without first drying. When the material for splitting was screened to pass a 10-mesh sieve the apparatus was found to give accurate samples if properly adjusted.

*Mining engineer, 1314 Park road, Washington, D. C.

A piece of sheet iron, ⅛ in. thick, about 10 inches wide by 36 in. long, was bent into the shape of a V-trough *A*, the angle of the V being about 60 deg. Care was taken that there was a sharp angle at the bend and that there were no crooks or rough places along its length. This sheet-iron trough was placed on a slope of about 35 deg. and secured by framework.

A hopper for holding the sample to be split was placed above the upper end. The lower end of trough *A* rested, as shown, upon an inverted sheet-iron V-trough *B* which was about 14 in. long and each side 7 in. wide. The angle between the sides was about 20 deg. This trough *B* was placed on an angle of only a few degrees from the horizontal and its apex was filed to a knife edge. In securing trough *B* to the framework sufficient play was allowed in order that its position could be shifted to adjust the knife edge to the flow from trough above.

The material from the hopper was washed into trough *A* by flushing it from underneath with a small stream of water from a ¼-in. hose. When the sample mixed with a large proportion of water reached the knife edge of trough *B* it was split and if the knife edge was placed midway underneath the stream flowing from trough *A* and the flow of water and sand was more or less even the two portions were found to be almost equal both in weight and gold content.

A sheet-iron V-trough *D* similar to the one leading from the hopper was placed under one of the sides of the inverted trough *B* and received one of the split portions. Trough *D* led the split material to the inverted trough *E* (similar to *B* and similarly placed), where it was again split.

One of the split portions from *E* passed to trough *G* and was carried to sample bucket. The sample thus taken represented a fourth of the original. Short troughs placed underneath the opposite sides of troughs *B* and *E* led the discarded portions of the material to the waste sump.

Increasing the length of the troughs leading the material to the splitting troughs beyond three feet is an advantage as it gives the flow of water carrying the material to be split a better chance of straightening itself out before striking the knife edge and more representative samples are the result. For fairly accurate results, however, they should not be less than three feet.

The process of splitting can be carried on indefinitely if sufficient elevation is allowed at the starting point. For a permanent wet sampler the device may be greatly improved but as here shown can be, as it was in this case, knocked together in any out-of-the-way place where material and facilities for doing nice work are not at hand.

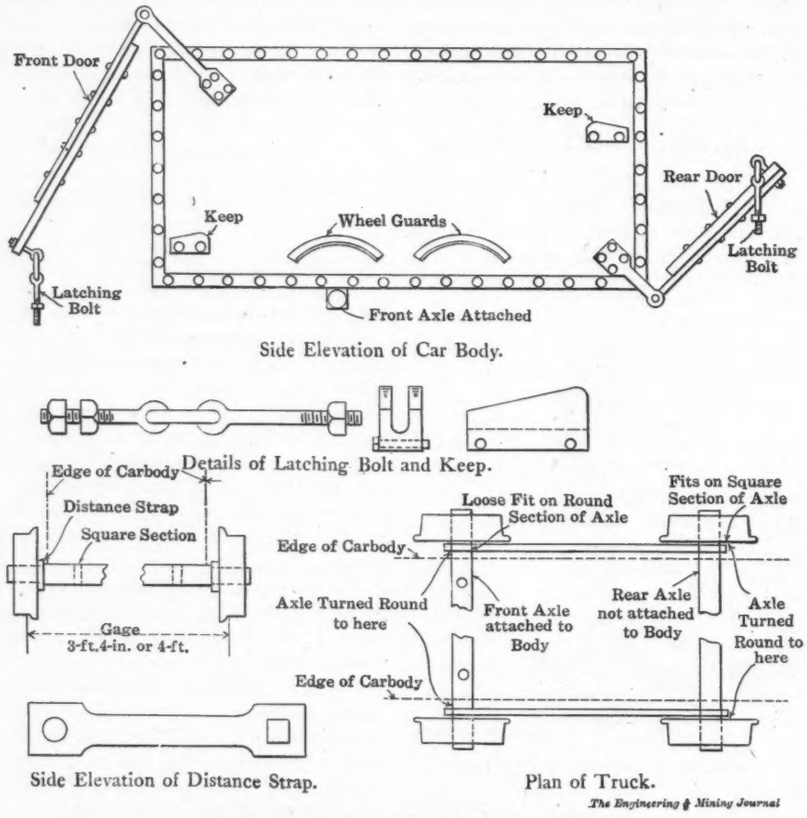
Calumet & Hecla Ore Cars

The Calumet & Hecla is one of the few companies in the Lake Superior copper district, operating mines where the ore is shoveled into the cars or loaded into them by hand from a sollar on the floor of the level, that uses ore cars having doors. At the other mines the cars are open at the front end and closed at the back. The men pile boulders at the front to hold in the finer dirt. This takes time, and time is wasted by the men loading the cars by building the wall more slanting than necessary, or by starting it a little back from the end. The only gain is that no door has to be opened when the car is dumped. But, as the loading of the skip is not planned for speed at these mines where the skips are loaded by dumping the cars directly into them, the few seconds required to open the front door is negligible.

All the Lake Superior cars are built with the body resting directly on the axles so as to allow them to be made with the sides as near the ground as possible. All are built to hold approximately 2½ tons and necessarily are made long, especially where the tracks have a gage of only 3 ft. 4 in., as at most of the mines, although a 4-ft. gage is used at the Calumet & Hecla mines. Owing to the wide gage the cars have to have a short wheel-base compared to their length so as to allow them to make the turns without cramping. The front axle is bolted directly to the body of the car while the rear axle is attached to the forward axle by two distance straps that slip loosely over the axles. The front hole in the strap is made circular to allow the axle to turn in it when the body of the car is being raised to dump, while the back hole is made square to go over the square part of the back axle. In the center of the back axle there is a lug that fits into a hole in the bottom of the body so as to prevent side swing while the car is being pushed along the track.

The front door of the car is made to swing up and is carried from a cross rod in the ends of two horns that extend above the car so as to afford plenty of space for rolling in boulders, while the door at the other end of the car is made to drop down so as to allow perfect freedom in handling the boulders. This door only comes two-thirds the way to the top, so as to allow the ore to be loaded without having to be thrown as high as the sides. As the rear door is sometimes used as an apron to aid in loading boulders, it is secured to the car by four straps instead of three, as in the case of the front door.

These doors are locked by a rather ingenious device. To the doors are fastened two bolts with nuts on them, a link intervening so as to give flexibility, as shown in the accompanying sketch.



TWO-DOOR CAR FOR TRAMMING BOULDERS

By means of the nut, which is a tight fit on the locking rods, the length of the locking pin is adjusted so as to give the proper amount of tightness when the bolt is down in the keeps. The keeps into which the locking bolts drop are made of cast iron and are bolted to the sides of the car. The back end of these keeps is slightly rounded so that the bolt is tightened as it is shoved down in them, while the bottom part is straight and designed to be perpendicular to the locking bolt when it is down in the keeps. A slight knock on the end of the locking bolt loosens it so as to open the gate, but the bind against the keep is sufficient so that no jar can loosen the door while the car is being trammed. The accompanying sketch shows the keep in detail. To keep fine rock from dropping on to the axles, wheel guards made of 2-in. angle iron are bolted to the side of the cars. The wheels, as on practically all the Lake Superior cars, are loose on the axles and are held on by keys.

A Temporary Scaffold

By A. Livingstone Oke*

The accompanying illustration, Fig. 1, shows a scaffold used in the Latin-American countries by masons when building high walls. Two frames are made from suitable boards, in the form of a right angle, and another length is nailed on the side to stiffen the brackets which are placed against the wall at the desired height for the platform on which the men will work and a pole of suitable length is jammed underneath, the foot being sunk in a pit or otherwise prevented from slipping outward.

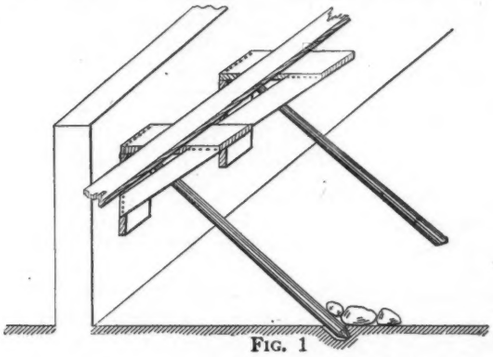


Fig. 1

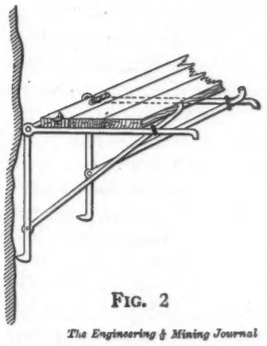


Fig. 2

The Engineering & Mining Journal

Scaffold for Masons or Miners

The brackets may be quickly adjusted to any desired height, by using longer or shorter poles, and planks are laid loosely on top to form the platform. On a perpendicular wall with a smooth face the whole arrangement is remarkably steady.

An adaptation of this scaffold for use in stopes and elsewhere underground is shown in Fig. 2 and consists in making the brackets of iron bars arranged as shown. This is a handy way of getting at high backs or drilling in places where ladders or scaffolding are necessary. The angle of the bracket is made adjustable to suit that of the face against which it rests, and the lower feet are made as wide as possible to prevent rocking, in case only a single bracket is employed.

In Fig. 2 is shown a bracket in which two of the bars of each triangle are passed through an iron ring, around which a piece of rope has to be tied when adjusting the bracket at the face. If desired a set of holes can be drilled in each and a pin used, but in the rough usage of a mine these become lost, bent or broken, and the form shown is to be preferred.

On the bracket, the board at the back has to be strongly bolted on, as this takes all the upward thrust of the pole or ladder underneath. If a bracket of this kind be used in conjunction with two poles or a ladder, only one bracket is needed for the use of one man. Such scaffolds are handier than a ladder when sampling is to be done in a high drift.

*Resident manager, San Juan Mines, Ltd., Rodeo, San Juan, Argentina.

Electric Pumping Machinery

By D. B. Rushmore*

A large number of mines are, due to the absence of natural drainage facilities, absolutely dependent on a pumping equipment for their continuous operation, and the importance of installing the most efficient system is at once appreciated when the enormous quantities of water, that in certain instances must be removed, is considered.

Electric Pumps Highly Efficient

The most important advantage of the electrically driven pump is its high efficiency[1], this in certain cases being as high as 70 to 75 per cent. or from 25 to 40 per cent. greater than for steam- or air-driven pumps. In the matter of flexibility, the merits of the electric mine pumps are, the ease with which they can be moved from point to point in the mine, and the economy of space, which should receive careful consideration in cases where the mine conditions demand that pumps be placed in the smallest possible room.

The pumps that are generally used for mining operation can be divided into three classes: the sinking pumps, used for development work or for emptying flooded mines; the main pumps, which are permanently installed in the mines; and finally the auxiliary pumps, used for pumping water into a central sump from various depressions in the mine which cannot be naturally drained.

The sinking pump is generally designed for being lowered in a vertical shaft and is either mounted on a float or suspended from the hoisting cable, so as to always operate at the surface of the water. The motors for operating these pumps can be either of the direct- or alternating-current type, but as they are often liable to be entirely submerged, the inclosed induction motor is preferable, on account of its simple construction and the absence of moving contacts. In the operation of these pumps the load increases inversely as the head, and the motors should be so designed that their efficiency increases with the increasing head.

Centrifugal Pumps Gaining Favor

The main pumps, which are mostly of large capacity, are used for emptying the sumps where the water from various parts of the mine is collected. If these sumps are of sufficient size for storing the water collected during the day, the pumps can be operated at night, and the load factor considerably improved. The pumps used for this service are either of the reciprocating or centrifugal type, of which the latter, in most cases, seems to be the most desirable. Although the centrifugal pump, in the past, has been adopted for conditions where the height of lifts has been moderate, and where larger volumes of water have had to be removed, the recent installations have indicated that remarkable improvement in the multi-stage centrifugal pumps now make them especially efficient and satisfactory for delivering water against heads of 1000 to 1500 ft. or more. This type of pump is particularly well suited for direct connection to high-speed motors, preferably of the polyphase induction type, thus eliminating the friction losses of a gear device. This space occupied by the centrifugal equipment is considerably less than for the reciprocating set and the ability with which it can handle muddy and sandy water is well appreciated.

The auxiliary pumps for pumping water from places below the main pump are either of the stationary or portable

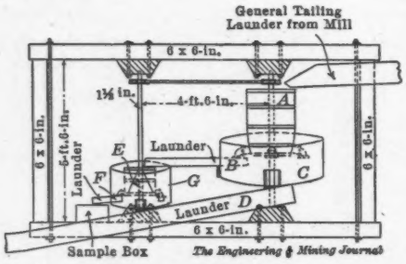
*Engineer, power and mining department, General Electric Company.

[1]Excerpt from an article entitled "Electricity in Mining," read before the American Mining Congress, Chicago, Oct. 24 to 18, 1911.

type. Owing to their large number and scattered location, they are mostly driven by direct-current motors receiving the current from existing trolley circuits. Of special interest among these pumps is the portable pumping set which is mounted on a truck and can easily be hauled to any portion of the mine by a locomotive, and immediately put into service.

An Automatic Tailing Sampler

All tailings from the mill of the Hudson Bay Mines, Ltd., in the Cobalt district, flow into a general collecting launder which discharges into the automatic sampling device illustrated by the accompanying sketch from the *Canadian Mining Journal*. The impact of the stream of sand, slime, overflow from the Callow cones and wash water from the floors causes the 20x30-in. barrel *A* to revolve. The tailing flows through the four 3-in. pipes in the sides near the bottom of this barrel. The outer ends of these pipes are fitted with elbows. Except when passing over the launder *B*, the pipes discharge into the circular collector *C*, thence the pulp flows into the lounder *D*, that leads to the pond.



TAILING SAMPLER AT HUDSON BAY MILL

The pulp discharged into launder *B* flows to a second barrel *E*, driven by a belt from the vertical spindle of the first barrel *A*. In the bottom of *E*, are four 1-in. pipes which, except when passing over the launder *F*, discharge into the collector *G*, to join the bulk of the discharge in the launder *D*. The pulp caught in the launder *F*, flows into the sample box as the final 24-hr. mill-tailing sample, which is sent to the laboratory to be dried and quartered for assay.

In hand sampling a cut of the whole stream was taken every 15 min. The cuts were collected in a washtub of 20 gal. capacity and allowed to settle before decanting the water. The results as obtained on four successive days were; heads, 26.1, 29.5, 26.8 and 20.4 oz. silver; tailings, 6.5, 5.5, 6.4 and 5.4. The automatic sampler was put into service for the next four successive days when the assay results obtained were; heads, 22.1, 20.4, 19.1 and 20.3; tailings 9.9, 8.2, 9.3 and 7.0. After using the automatic sampler it was found that the losses were 10% greater than had been anticipated.

Filing Engineering Notes

The filing of notes and clippings is an excellent practice that may develop into a habit or mania with the result that an attempt is made to preserve too many "data." For filing such notes there are almost as many systems as there are engineers.

To be of service the notes must be filed so as to be readily found when needed. The system should be self-indexing, for too much time is required for writing up card indexes, and the job of indexing and filing will often be left until an overwhelming accumulation induces the engineer to cast the entire lot into the waste basket and quit.

The system here described needs no separate index. Use either the pasteboard transfer files commonly used in offices for filing letters or, better and more compact, the smaller pamphlet cases. Tear out all the "innards" of these cases and cut a number of thin bristol-board pages the exact size of the case. Label these at the upper left-hand corner with the subjects, as *Pumping, Stoping, Shaft Sinking,* etc., under which captions the classification of the notes is to be made. Put these dividers in the case and insert the clippings and notes in front of each divider, according to subjects. The large letter cases will take an unfolded sheet of the JOURNAL; for the pamphlet cases the pages are folded once with caption at the top and facing outward.

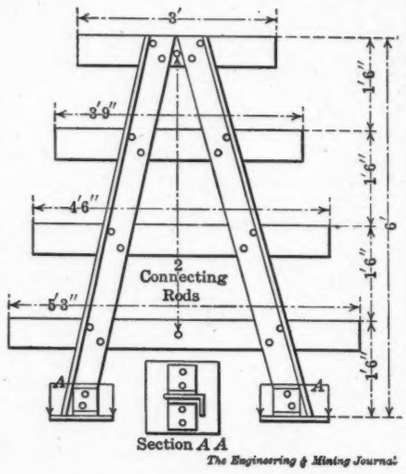
When looking for a note on any subject, remove all the notes from in front of the marker and lift one by one until the article is found. This takes but a minute and is preferable to spending time in making indexes for closer locating of an article. When the notes on any one subject have accumulated so that it takes several minutes to look them all over, reclassify the lot under two or three more specific captions, making new cards or dividers for each, and return to the place the original lot occupied in the case.

When two articles on one page are to be preserved, file under one caption; then use a sheet on which the title of the second article is written, the caption the article is filed under and the caption of the accompanying article. This sheet is to be filed under the caption of the second article. One sheet may be used for reference to a number of articles. For example, in looking for an article on pumping, this sheet will be found together with the notes on pumping and will indicate that the article "Centrifugal Mine Pumps" is filed under *Hoisting* on the same page as the article entitled "Life of Hoisting Cables."

The cases themselves are labeled on the back with a general title indicating the nature of the captions and articles and notes it contains. Thus any case may be made like a book on any subject, the captions of the bristol-board dividers being similar to chapter captions of a book. The advantage of the system is that the original filing can be done quickly, no writing of any kind being necessary except when several articles are printed on one page. The disadvantage of having to look through all the articles in one "chapter" to find the one wanted is outweighed by the time saved in the original collecting and filing. A copy of the JOURNAL can easily be torn apart and all the articles filed in five minutes.

Storing Iron and Rails

At many mine shops, storage space for iron stock and rails is limited, making it hard to find iron that is specified for certain work. Unless the blacksmith has plenty of room to spread out the iron, it will be hard for him to find the kind



A RACK FOR STORING IRON STOCK

specified in a certain drawing. Furthermore, if the iron be stored according to lengths, the making of unnecessary scrap may be avoided by selecting stock of the approximate length required.

A rack like that shown in the accompanying sketch from *Shop Notes Quarterly*, will save space, as well as time and labor, making it easy to sort the material, so that it can be found readily. These racks are cheap and strong, and can be made of any scrap material. Of course, the strength of the racks is to be governed by the weight of the material to be placed on them, although it is advisable to make them strong enough for the general run of stock used in the shop.

At the Broken Hill South Silver Mining Company in New South Wales, contractors' earnings varied as follows: Miners on development work, $4.06; stoping, $3.61; ore truckers, $2.53; muck truckers, $2.42 per day.

Notes on Pyritic Smelting

By George A. Guess*

Pyritic smelting defined as the production of a ferrous-silicate slag from iron-sulphide ore. There are two great variables, blast and silica; the first alters tonnage, the second the ratio of concentration.

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What is pyritic smelting? Regarding pyritic smelting as practiced in America, several terms have been used to characterize it. We have heard of pyrite smelting and later of pyritic and of partial-pyritic smelting; the differences between the last two being characterized by an arbitrary dividing line of coke consumption. When more than so much coke is used it is partial-pyritic smelting. When so much or less is used it is pyritic smelting. I cannot see that the process is essentially changed when the amount of coke used on the charge is increased in reason, and often the increase or diminution of the coke used is as much a commercial as it is a metallurgical problem. I should like to see a more definite meaning attach to the term pyritic smelting; and in my own work, have always considered when a slag essentially high in iron is made from a charge containing its iron as a sulphide only, that pyritic smelting is being done, whether 2 or 20% of coke is being used.

Pyritic Smelting Is Slag Formation from Sulphide Iron

With low coke the metallurgist may be getting a greater pyritic effect in his blast furnace than when he is using a higher coke percentage, but his work is pyritic in both cases. It is the absolute necessity of oxidizing iron sulphide in the presence of silica, before slag formation can take place, that distinguishes pyritic smelting. If in doing this the metallurgist uses so much coke that, let us say, half of the air going into the furnace is used in burning his coke, the essentials of the process are not altered, because no matter how much coke he burns, he cannot make slag until he has oxidized his iron sulphides.

We will therefore call pyritic smelting the art or practice of smelting a charge in which all the iron present is combined with sulphur, to produce a ferrous-silicate slag. The tag on this definition is added to exclude an operation when sufficient iron sulphide is present to form matte, but the slag is high in lime and magnesia. We exclude therefore all consideration of how much coke is used in the operation. The effect of the variations in the amount of coke used in pyritic work will be spoken of later.

Blast Calculations in Coke and Sulphide Smelting

Blast-furnace ores of the Southwest are getting yearly more sulphuric in character, and the time will come when probably pyritic smelting will be practiced in several of the older plants of the West. A condition essential to success in pyritic smelting is the removal of the fine ore. With the fine ore removed, pyritic work offers such great possibilities in the reduction of the amount of coke used, that its application wherever possible is almost sure to result in diminished costs. One pound of oxygen expended in burning FeS and forming slag generates 2.46 heat units, while one pound of oxygen used in burning coke generates 3.05 heat units; so that there is not much difference in the amount of heat produced with a given volume of blast under proper conditions.

The pound of oxygen will burn approximately 1.84 lb. of FeS to slag, while the one pound of oxygen will burn approximately 0.45 lb. of ordinary coke. Therefore, in a furnace taking a uniform amount of air, which we assume is all used in burning coke, and FeS in the presence of silica to ferrous silicate, one pound of coke will take the place of four pounds of such FeS in the consumption of that air. Or, for every pound of coke burned per minute, about four pounds of FeS must remain unburned. In a furnace then, that is smelting say, a charge of sulphide ore and flux, in which the iron going into the slag forms 25% of the charge, about 10 lb., of charge remain theoretically inactive for each pound of coke burned, the consumption of air remaining constant. These are purely theoretical calculations, but such figures are useful.

In a pyritic furnace running open and hot, I have noted that when the amount of coke is reduced the furnace speeds up. This increased tonnage will be maintained until a new balance is obtained, and if the coke was properly adjusted in the first instance, the furnace may get noticeably colder in a few hours. If the furnace has a cold top, or if we neglect the temperature of the gases escaping if it has a hot top, we may assume that the pound of coke burned in the furnace, leaves its heat in the furnace. The four pounds of FeS burned in the furnace to slag produces about eight pounds of slag, with, say, 40% FeO which runs from the furnace, bearing with it approximately 30% of the heat so formed. This is a considerable item, and in a consideration of the action of the burning of the coke and of the sulphide must not be overlooked. The burning coke produces heat only, while the burning sulphide produces heat and slag, which carries off a large proportion of the heat so formed.

Adding Silica when Slag Is Too Siliceous

This generation of heat from the sulphides constitutes the basic principle of pyritic smelting. In dealing with pyrites, we will assume the formula of the reacting substance to be FeS in all cases. The equation for the reaction is therefore

$$x\text{FeS} + y\text{SiO}_2 + 3x\text{O} = x\text{FeO}.y\text{SiO}_2 + x\text{SO}_2.$$

The three substances represented by the left-hand side of the equation must all be present, and I consider the reaction is essentially one, and does not by any manner of means take place in two stages. When not enough silica is provided, the reaction taking place will be proportional to the amount of silica that is present, until the activity per cubic foot of charge, diminishes to such an extent that the temperature of the focus of the furnace is lowered. We will then have a colder slag, more siliceous than the normal furnace slag and a lower-grade matte. The remedy for this undesired condition is to increase the amount of silica on the charge. This increase of silica to a furnace producing a slag already too siliceous in order to correct that slag, appears an anomaly to a metallurgist unfamiliar with pyritic smelting. I think I have given above what serves to explain this. To one who has done successful pyritic work, it is the natural thing to do. I do not wish, however, to be understood as saying that when a pyritic furnace is producing too siliceous a slag the proper remedy is always more silica on the charge.

Silica the Great Variable

In pyritic work, the metallurgist depends almost entirely on his silica, to change his furnace condition or ratio of concentration. If his ores are suited to the process, it may be possible to vary the ratio of concentration at will, from 4: 1 to as much as 15: 1 or more. From the speed of the furnaces under these varying conditions, and the amount of copper contained in the slag, will be determined the most economic conditions under which to work. Making a low ratio of concentration and resmelting the resulting matte may materially improve the copper extraction obtained by one furnace operation. The resmelting of matte to converter grade offers one of the simplest problems in pyritic work. Low-grade copper matte is much the same

thing wherever you find it, with almost a definite analysis. On the other hand, ores may resemble each other in analysis, but behave differently when smelted. Some sulphides decrepitate to such an extent in the furnace that they produce a blanket of fines on the charge, interfering materially with the correct working of the furnace.

Two-stage Smelting Often Desirable

The resmelting of low-grade matte where it is possible to obtain clean siliceous ores and enough limerock to make a rapid running, clean slag, is accomplished with little coke, and at times with phenomenal furnace speed. A striking example of both coke and tonnage is the following tonnage which was smelted in a 56x180-in. furnace in 24 hours: Matte, 505 tons; quartz, 202 tons; limerock, 86 tons; total charge, 793 tons. The coke used was 13.5 tons which is 1.7% coke on the charge. The furnace took 21,515 cu.ft. free air per min. This is unusual running and low coke. It suggests, however, the ease with which matte may be concentrated and the low cost of the operation. Making a low-grade first matte and resmelting will in many cases make a better copper recovery and result in a greater ore tonnage through the plant than single-stage work, due to the more rapid running of the furnaces when not called on for such a high ratio of concentration.

The practice offers other advantages. If as sometimes happens, the blast-furnace ores change to such an extent that the matte going to the converters is so low-grade that that department is swamped, and despite all efforts it seems impossible to increase the grade of the matte, it often relieves matters materially, if the plant is so arranged that low-grade matte can be handled for resmelting, to make the blast furnace make even lower-grade matte, and after accumulating a stock, resmelt to a grade to suit conditions. In a plant where difficulty is experienced in maintaining the matte at converter grade, the practice of resmelting at least a part of the low-grade matte makes the unit more flexible and may enable the converter department to do better work.

Poor Policy Refeeding Matte on Ore Charge

The resmelting of this matte by adding it in small doses to the ore charge, regularly or when desired, serves merely to get rid of the matte. It does not enable the metallurgist to realize its fuel value and often it comes from the furnace no better grade than when it was put in. It is only when this matte is resmelted pyritically that the total metallurgical and commercial advantages are realized. The presence of considerable lead in the matte does not appear to affect the operation. Its presence in matte as in ores appears always to result in a settler slag lower in copper than is ordinarily the case, which observation, however, has nothing to do with pyritic smelting.

During four years of pyritic smelting, observations I have made have in many cases forced me gradually to abandon many accepted theories of what actually goes on in a pyritic furnace. Freeland in 1903 published a sketch, with which everyone is familiar, showing the probable structure of the interior of a pyritic furnace. This sketch has since been used wherever anyone has exploited new theories in this connection, and around it have been woven explanations of the whole physics and chemistry of the process. As regards the sketch, I have seen furnaces that when blown out lived up to it in appearances. But, I have seen many more normal-running furnaces put down, some without an attempt at running down, which showed no such structure. The generally accepted theory, I think, is that there exists in the pyritic furnace an open, porous, siliceous skeleton, over and through which molten matte trickles, and that this network of silica is used up as the matte is oxidized, being slagged by the iron oxide formed, but is constantly replenished by silica coming down the furnace shaft in the charge. The whole operation seems to be considered mechanically somewhat analogous to pouring water containing lumps of sugar into a porous vessel partly filled with such lumps. The theory is indeed a beautiful one, and can be used to explain a great deal that goes on in a pyritic furnace. To take its place, I confess, I have none at all.

Siliceous Zone Not Found in Blown Out Furnaces

The following observations have forced an abandonment of this theory. In digging out furnaces, I have repeatedly failed to find the siliceous zone. An analysis of the material where it should be, at times would not differ materially from the furnace charge. And these cases were most often from furnaces that had been shut down in the midst of good running. In blowing in a furnace for matte smelting with a charge of low matte, quartz and limerock, the first matte from the furnace may be made converter grade, and accompany slag in abundance without slag having been charged. In this case all possibility of the theory must be set aside. This theory presupposes a siliceous excess on hand in the furnace. Now, if we accept that as a fact and we are smelting, say, 10% matte with silica and limerock to converter grade, and find our resulting matte too low, how are we to raise it? We are told more air—that means greater pressure.

The air is really the only thing we can change if we assume that we have already in the furnace an excess of silica. But raising the blast will not raise the grade of matte. It will increase temporarily the activity of the furnace. If, however, we leave the air alone and raise the silica on the charge, we do at once change the grade of matte. In a normal-working pyritic furnace, I think that the charge sweeps through the furnace and out, and that there is no material melting of any constituent of the charge beyond a mere pastiness, until the whole charge reaches the fusion zone, where the reaction to slag takes place, to the extent permitted by the composition of the charge.

Considerable light was thrown on this question for me about a year ago. The end of a furnace, otherwise in good shape, hung up hopelessly. It was decided to try and dig that end out while the furnace was running. The furnace was 56x270 in. The end jacket was taken off, and the tuyeres on that part closed. The cold charge was taken out in the ordinary way for a distance of seven feet up to the active portion of the furnace. This wall was perfectly stable, and when picked into, appeared to hang together because it was pasty, but no molten material showed. The face was cleaned up to "the red," the jacket put on and calked. Then for 10 min. the blast was taken off while two men descended from the feed floor and made an opening on a level of the bottom of the freshly dug-out portion (about 6 in. below tuyeres) into the active part. This new part was then at once blown in and the operation was a success. The time taken was about 12 hours. The blast was off only 10 min. I had expected that we might poke through into a hot mass of slag and matte, but all we found was pasty, red-hot charge.

Matte an Ideal Pyritic Material

In the pyritic smelting of low-grade matte, we have an ideal material with which to work. Most ores are more or less complex and the nature of the gangue in the ore often interferes materially with the smooth running of a pyritic furnace. We will, therefore, assume we are smelting matte containing 10% copper carrying 95% SiO_2 and pure limerock sufficient to make 12% CaO in the slag. We have an unlimited supply of air and may run the pressure up to 50 oz. Our furnace is running normal and we are making a 35% matte and a slag as follows: SiO_2, 35%; FeO, 47%; CaO, 12%. Blast pressure, 35 oz., and furnace taking 1200 cu.ft. of free air per min. per ft. of furnace length.

Now there are two main things we can change: The silica on the charge, or the air pressure. Changing the percentage of matte on the charge is the same as

changing the silica, changing the amount of limerock is not of great moment. It is there, first to make a clean, more fusible slag, and second to increase the speed of the furnace, reasonable changes in its amount do not materially affect the furnace running. Changing the weight of the charge and changing the height of the charge line in the furnace, as well as the changing of the coke, we will not consider here.

Effects of Blast Change

If we change the amount of blast, dropping the pressure to 25 oz., what happens? First, the stream from the furnace is reduced in size, and the number of charges that the furnaces takes per hour is reduced in quantity. Later on, the furnace may show the following changes. The top of the charge shows red less often, because the fusion zone is lower down in the furnace. The slag is not so hot, and the analysis may show less FeO. This will happen if the furnace has a narrow margin of heat. The activity per minute has been reduced, and until the furnace resistance has been reduced by a better tuyere condition, the furnace takes less than 1200 cu.ft. free air per min. per foot.

The daily tonnage of the furnace is less, and through that lessened tonnage, due to less heat generated per minute, the change may threaten the temperature of the slag and its analysis and consequent grade of matte, but that only if the furnace fails to keep hot. A new condition is imposed on the furnace which has greatly to do with the shape of the furnace. It may bring the fusion zone too low in the furnace or affect the mechanical side of the furnace in other particulars, but the main thing is that it changes only the rate of smelting for the reason, that with the same oxygen efficiency in the furnace, a lessened quantity of air is going to do a proportionately lessened quantity of work. The same charge is needed, but less of it.

Blowholes from Increased Blast

Similarly, if the blast pressure is raised, we increase essentially the rate of smelting the selfsame charge. But we may assume that the metallurgist running at 35 oz. has found that pressure best suited to his furnace, and that, though by increasing the pressure, he may increase his rate of smelting temporarily, still increased blast has drawbacks. It may raise the focus too high, the top gets hot, blowholes form. All these results are, however, more the commercial side, because a smelter knows exactly what a blowhole costs, and how much it costs in labor and lost time to dig out and start over again. He may also find it better to drive hard than to drive well.

Effect of Increased Silica

Now, when we change the quartz, we change the charge, and the whole process. Let us increase the amount of quartz materially, but in reason. What happens? We have so much more silica to put into slag. A proportional amount of FeS must be oxidized with it. Less iron goes into the matte, more into the slag. A proportional amount more of air is needed. We have made no change here, however, accordingly slightly less tonnage will be put through. Essentially what happens is that the furnace makes, as soon as the charge gets down, a slag higher in FeO; it looks hotter; the accompanying matte is higher grade. The oxygen ratio of the slag is changed; it is slightly more basic. We have changed the charge, and the result is a change in the type of slag and in the grade of matte made. Incidentally, we may find that the air is used more economically in the furnace; that the oxygen efficiency has gone up 1 or 2%. I have always found high oxygen efficiency goes with a high ratio of concentration. We may find the changed ratio of concentration suits the furnace; it gets hotter, the furnace resistance goes down, and consequently with our blast pressure of 35 oz. we may find the furnace taking 1300 cu.ft. per min. per ft. of furnace. The first change, however, and the one looked for is a slag higher in FeO. This change in the slag precedes the change in the grade of the matte some two or three hours.

When the extra quartz is added we have a hotter furnace, because we are doing more oxidizing per cubic foot of charge in the furnace, but not more per minute. The temperature of the focus of the furnace rises, and a slag of slightly higher formation temperature is the result. There is a vast difference between increasing the activity per cubic foot of charge in the furnace and increasing the activity per minute. The first means higher ratio of concentration and is brought about by increasing the silica. The second means faster smelting and is dependent solely on the volume of air per minute. Of course, when this increased volume of air is obtained by lessened furnace resistance instead of increased pressure, things are running smoothly.

The volume of air that a furnace will take, depends on two things, and may be expressed thus: $\frac{P}{R} = V$, where P is the pressure, R the furnace resistance and V the volume of air.

Pyritic Furnace Chooses Own Charge

A pyritic furnace is said to choose its own slag. I have also found that it has a great deal to say about the air it will take. It is one thing to say, "give the furnace more air," and another to make it take it. So much is this so, that the efforts of the smelter are continually directed to getting as many pounds of oxygen per minute into the furnace as he can for speed, and at as low a pressure as possible for power and the better working of the furnace. So that in practice the only real variable that the pyritic man has is his quartz.

In smelting iron sulphides low in copper with a low-silica content, the amount of quartz that may be added, may be from nothing up to 30%, or more. Here the range is great, and the metallurgist may make swift and sudden changes in his charge. He has a wide range through which he may vary his ratio of concentration, and the furnaces may be made to respond sharply. But, given a sulphide ore where the silica content is quite high, so high in fact, that little or no room is left for added quartz; and here surely the furnace makes its own slag and its own matte, and has, too, a great deal to say about how it will run generally.

The slag made under these conditions will not vary materially when the furnace is running well. But with the low silica, and say, 2% of copper, the slag will vary with the ratio of concentration and may run from 39% FeO where an 8% or 10% matte is made to 48% FeO where a 35% matte is made. The oxygen efficiency in the first case is possibly as low as 65% and as high as 85% in the second.

In a pyritic furnace the oxygen duty is comparatively easy to calculate. The metallurgist will arrive at a factor which he will use for his oxygen to sulphur (for all the sulphur eliminated is not burned), and his monthly metallurgical calculations of the furnace gas, from the air furnished, checked by analyses of the furnace gas made, will give him this figure. I have used 90% of the eliminated sulphur as being burned by the oxygen of the blast.

Sampling Furnace Gases

The sampling and analysis of blast-furnace gases is not always well done. I have always found free oxygen in pyritic-furnace gas, except when I drew my sample through a metal pipe which the furnace temperature had heated to redness. In this case, of course, all the oxygen of the sample was taken up by the red-hot metal, and I found next to nothing. Dampering back the furnace gases till the top takes in no false air permits the taking of a good sample. The determination of SO_2 with decinormal iodine is easy. Oxygen absorbed by phosphorus is easy, but CO_2 and SO_2 present greater difficulties. What often happens is that CO_2 and SO_2 together are reported as CO_2. CO in small quantities is very uncertain, and the analyst, when honest, often has a minus instead of a plus. One must take into consideration, of course, the conditions under which the analyses have necessarily to be performed. Calculated analyses for a month's running and average

analyses taken during the month often check closely.

We will now go back to our furnace smelting matte, and calculate the analysis of the gas that it is producing. We will assume the following analyses: First matte, 10% Cu, 56% Fe, 26% S; second matte, 35% Cu, 35% Fe, 24% S; slag, 35% SiO_2, 47% FeO, 12% CaO; quartz, 95% SiO_2; limerock, 53% CaO, 42% CO_2; coke, 83% C.

To simplify matters we will neglect the copper and sulphur in the slag. We will assume 3% of coke in the charge, neglecting its ash, and that the barometer and thermometer are such that 1000 cu.ft. of free air contain 16 lb. oxygen; and that the furnace smelts 612 tons of charge per 24 hours, made up as follows: Matte, 350 tons; quartz, 162; limerock, 100; coke, 18.36 tons. Our 24-hour charge is then as follows, in tons: Cu, 35; Fe, 196; S, 91; SiO_2, 154; CaO, 53; CO_2, 42; C, 15.2; of which 35 tons Cu, 35 tons Fe, and 26 tons of S go to matte, leaving a net of 161 tons Fe to go to slag and 65 tons of S to be eliminated.

The furnace is taking 1200 cu.ft. of free air or 19.2 lb. of oxygen per min. per ft. of length, and, we will say, is 15 ft. long; the total tonnage of oxygen then per 24 hours is 207 tons.

Calculation of the Oxygen Efficiency

Then if 90% of the S is burned, i.e., 58.5 tons, there will be 58.5 tons of oxygen required, giving 117 tons of SO_2. The 161 tons of iron will require 47 tons of oxygen; 15.2 tons of carbon will require 40.5 tons oxygen, giving 55.7 tons CO_2; while the limestone will give off 42 tons of CO_2. The total oxygen used will be 146 tons, and the unused oxygen will amount to 61 tons. The nitrogen with the oxygen will be 694 tons.

The accompanying table shows the composition of the effluent gases.

	Tons, gas	% wt.	% vol.
SO_2	117.0	12.1	6.0
CO_2	97.7	10.1	7.2
O	61.0	6.3	6.2
N	694.0	71.5	80.6
	969.7	100.0	100.0

Oxygen efficiency, 70.5%.

If we were to make the same calculation for an ore furnace where the ratio of concentration is greater, and amount of coke say, 5% on the charge, we would have a resulting gas richer in SO_2, about 83% nitrogen, and about 5% CO_2. Analyses of gases from a pyritic furnace are always a good check on the coke being used.

The higher oxygen efficiency which accompanies higher ratio of concentration, appears natural when one considers that a higher ratio of concentration is a result of increased activity per unit of charge in the furnace. It is the higher oxygen efficiency that helps to maintain furnace tonnage, when the furnace is made to increase its ratio of concentration by increasing the percentage of silica on the charge. Otherwise, the tonnage duty of the furnace would drop, due to the increased oxidation necessary to make slag of the new charge being fed. If the new charge works well, it will lessen the furnace resistance, and so enable the furnace to take more air without raising the blast pressure. It may also be, that under the new conditions, it may help the furnace to stand an increase of blast pressure. In either case, the increased air will increase the activity of the furnace per unit of time, while the increased amount of silica will increase the furnace activity per unit of charge in the furnace. We may sum this up thus: Increasing the volume of air increases the furnace activity per unit of time and spells tonnage. Increasing the silica on the charge increases the furnace activity per unit of charge in the furnace and spells increased ratio of concentration or higher mattes.

Heat Consumption of the Pyritic Furnace

The first gives us a certain number of gross heat units per unit of charge, and maintains the same grade of matte and type of slag, irrespective of the volume of air used, unless that air is reduced to such an extent that the furnace activity per minute drops so low that the radiation of heat from the furnace cools it to such a point that the temperature of the focus of the furnace falls below the formation point of the slag. Then we have trouble. For the net heat generated in the furnace, we have, of course, the three avenues of escape: (1) Radiated heat, jacket water; (2) slag and matte (3) gaseous products and flue dust.

The first of these, radiated heat, is almost independent of the furnace activity, and is for a pyritic furnace, much less than in ordinary smelting. It is, therefore, when the tonnage activity of the furnace reaches such a point, that the percentage of heat lost through radiation becomes much greater or much less than normal, that the temperature of the focus of the furnace is affected, and a new condition has to be met. We see then, that under a wide range of tonnage activity, the type of slag and grade of matte, will remain constant and independent of the rate of smelting, and the charge will be written to suit this condition.

Limits of the Range of Concentration

A change in the ratio of concentration produces a new plane on which the furnace operates, and one may say that the ratio of concentration attainable is limited by the temperature that it is possible to maintain in the focus of the furnace, by increasing its activity per unit of furnace charge. Running to an extreme in this direction, we will generate too little heat per unit of time. The percentage of radiated heat goes up, and the furnace limit in concentration is reached.

Within reasonable limits then, we may say that the greater the activity of the furnace per unit of charge in the furnace, the higher the temperature of the focus, the higher the grade of the matte, and the more basic the type of slag produced. Just what slag the furnace will make for a given ratio of concentration, the metallurgist will find out by experiment, and then write his charge to suit the concentration desired.

A Pro Forma Charge

Let us picture a furnace in operation which, when charged to the stock line contains, say, 50 tons of charge, and suppose that the stock line is 10 ft. above the tuyere line. Let us assume that the charge contains 50% of iron sulphide and is so arranged that 70% of the iron and its accompanying sulphur is being oxidized. We will then have 70% of the 25 tons of iron (or 17.5 tons of iron) which are in the furnace at a given period, which will be slagged before leaving the furnace. This work we may say is done by the air passing through the furnace. We will assume that the oxygen efficiency is known, and is 65%. Now, 100 volumes of this air, in passing through the furnace, meets the furnace charge, and does work represented by the oxidation of 17.5 tons of iron and its accompanying S. It can do no more, because the silica has been added for just this amount of oxidation. We find 35% of the oxygen in this air, however, has done no effective work. Now we will change the charge by increasing the silica so that 90% of the iron in the furnace at a given time, is going to be slagged before leaving. Is it not reasonable to expect that 100 volumes of air in passing through the furnace, now finding more work to be done in its passage, does more efficient work, and the percentage of unused air is smaller? This seems reasonable, and is exactly what is found in practice, that the increased ratio of concentration results in a higher oxygen efficiency.

For all calculations of oxygen efficiency, it is, of course, necessary to go to the blower and not to the gas analyst. This increased oxygen efficiency with increased ratio of concentration is found also in converter work. In converting 50% mattes, the ratio of concentration is 2:1 with a 30% matte, 3.3:1. I have always found a higher oxygen efficiency in the converter department during the month when the mattes were low than

when the mattes were high. The cases are not parallel but similar. A concentration furnace smelting say, 10% matte to 35%, has a low ratio of concentration, and as such always has a reputation as a prodigal user of blast. This oxygen efficiency is higher than the converter oxygen efficiency, however, and at a much lessened pressure; so that only where power is cheap, might it be economy to treat a low-grade matte in a converter instead of in a blast furnace.

Effect of Too Siliceous a Charge

A normal pyritic furnace, in normal condition, produces with each change in ratio of concentration, a different type of slag. We have then a given charge, from which we obtain a fixed ratio of concentration and a certain type of slag. It is next to impossible with this given charge to change the ratio of concentration, by forcing more iron to combine with the silica of the charge than the type of slag calls for. By cooling off the furnace, perhaps dangerously, we may satisfy the silica with less iron and lower the grade of matte, in which case, we are piling up in the furnace an excess of silica, represented by the difference between the silica on the given charge, and the silica required for a charge that gives the ratio of concentration we are now making.

We have now, however, a furnace that is not normal as we have been using the term, although a condition common enough in practice. Our furnace is receiving the given charge as fast as it is smelting, but because the furnace is too cold in its focus to make the necessary concentration called for by that charge, it is doing less work per unit of furnace charge, and is as your furnaceman says, "not smelting its silica." The furnace is making a lower grade of matte, and a more siliceous slag than originally intended. Here then we have a condition that in appearance is similar to the case cited earlier in this paper, where more silica was the logical remedy. Here the obvious course is to suit the charge to the furnace until a rising temperature will permit a raising of the ratio of concentration.

From this illustration above given may be deduced many fundamentals of practice. Of these, perhaps the most important is that underlying the change in ratio of concentration. Increasing the silica on the charge is the means of raising the ratio of concentration. An increase in the ratio of concentration means an increase in the temperature of the focus of the furnace and a resulting slag higher in FeO and lower in silica. Now, if the furnace is not sufficiently active and hot, it will not respond to the demand put upon it and will not smelt this increased silica. The slag and matte will remain as they were and the silica accumulates in the furnace. Moral—always keep a hot furnace.

In the matter of silica for the furnace in pyritic smelting, the higher the percentage of silica in the quartz or siliceous ores, the better for the furnace. In matte smelting where all the silica is added it is possible to use a lower grade of silica than in ore smelting, where, possibly, the ore contains already a considerable amount of combined silica. A reasonable amount of silicates in the ore can be taken care of, but as these increase in amount, it is advisable to obtain as high grade a silica as possible for additional flux. Combined silica or a poor grade of flux naturally retards furnace activity, the decomposition takes heat, and as they increase in amount so do the difficulties attendant on maintaining a fixed ratio of concentration.

Silica Influences Concentration; Blast, the Tonnage

Silica means ratio of concentration and air means tonnage. We have glanced at the effect of a low grade of silica on the furnace; let us glance at the effect of a low grade of air. We have been smelting at an altitude where 1000 cu.ft. of free air contains 16 lb. of oxygen. Let us assume operations where 1000 cu.ft. of free air will contain only 9 lb. We have expressed the volume of air that a furnace will take as being $\frac{P}{R} = V$, where P is the pressure and R the furnace resistance. Our furnace resistance is going to be the same and so is the pressure, so that our furnace will take the same volume of air per minute. We will assume again that this volume is 1000 cu.ft. of free air per foot of furnace length per minute. This is 9 lb. of oxygen per minute instead of 16 lb. Of course, our furnace is going to run more slowly. We have noted that of the three sources of heat loss, the only one that is practically independent of the speed of the furnace is the loss from radiation.

We will here have then a greater percentage of the furnace heat lost through radiation (jacket water) in addition to a lessened activity per unit of time. These are the two great factors that determine furnace temperature. We are going to have a comparatively cold furnace also.

A pyritic furnace under these conditions will make a siliceous slag, and a comparatively low ratio of concentration which is extremely difficult to increase. Adding oxidized iron to the charge in the form of converter slag, and smelting this with coke, is a departure from what we are now considering. The pyritic furnace smelting with a poor grade of air (rarefied) is confined within narrow limits of concentration, as is a pyritic furnace smelting with a poor grade of quartz, but with the additional handicap of small furnace tonnage.

International Atomic Weights

The International Committee on Atomic Weights, 1912, composed of F. W. Clarke, T. E. Thorpe, W. Ostwald and G. Urbain, has made its report for the year[1].

A number of important determinations have been made on no less than 18 elements, but new values have been accepted only in seven cases, shown by an asterisk in the accompanying table. One of these, niton, is a "new" element. It is a radium emanation, investigated by Gray and Ramsay, and by Debierne, who used a different method.

INTERNATIONAL ATOMIC WEIGHTS, 1912

Element	Symbol	Weight
Aluminum	Al	27.1
Antimony	Sb	120.2
Argon	A	39.88
Arsenic	As	74.96
Barium	Ba	137.37
Bismuth	Bi	208.0
Boron	B	11.0
Bromine	Br	79.92
Cadmium	Cd	112.40
Caesium	Cs	132.81
Calcium*	Ca	40.07
Carbon	C	12.00
Cerium	Ce	140.25
Chlorine	Cl	35.46
Chromium	Cr	52.0
Cobalt	Co	58.97
Columbium	Cb	93.5
Copper	Cu	63.57
Dysprosium	Dy	162.5
Erbium	Er	167.7
Europium	Eu	152.0
Fluorine	F	19.0
Gadolinium	Gd	157.3
Gallium	Ga	69.9
Germanium	Ge	72.5
Glucinum	Gl	9.1
Gold	Au	197.2
Helium	He	3.99
Hydrogen	H	1.008
Indium	In	114.8
Iodine	I	126.92
Iridium	Ir	193.1
Iron*	Fe	55.84
Krypton	Kr	82.92
Lanthanum	La	139.0
Lead	Pb	207.10
Lithium	Li	6.94
Lutecium	Lu	174.0
Magnesium	Mg	24.32
Manganese	Mn	54.93
Mercury*	Hg	200.6
Molybdenum	Mo	96.0
Neodymium	Nd	144.3
Neon	Ne	20.2
Nickel	Ni	58.68
Niton*	Nt	222.4
Nitrogen	N	14.01
Osmium	Os	190.9
Oxygen	O	16.00
Palladium	Pd	106.7
Phosphorus	P	31.04
Platinum	Pt	195.2
Potassium	K	39.10
Praseodymium	Pr	140.6
Radium	Ra	226.4
Rhodium	Rh	102.9
Rubidium	Rb	85.45
Ruthenium	Ru	101.7
Samarium	Sa	150.4
Scandium	Sc	44.1
Selenium	Se	79.2
Silicon	Si	28.3
Silver	Ag	107.88
Sodium	Na	23.00
Strontium	Sr	87.63
Sulphur	S	32.07
Tantalum*	Ta	181.5
Tellurium	Te	127.5
Terbium	Tb	159.2
Thallium	Tl	204.0
Thorium	Th	232.4
Thulium	Tm	168.5
Tin	Sn	119.0
Titanium	Ti	48.1
Tungsten	W	184.0
Uranium	U	238.5
Vanadium*	V	51.0
Xenon	Xe	130.2
Ytterbium	Yb	172.0
Yttrium	Yt	89.0
Zinc	Zn	65.37
Zirconium	Zr	90.6

[1]Journ. Am. Chem. Soc., Nov., 1911.

American Chemical Society

The annual meeting of the American Chemical Society began in Washington, Dec. 27. On the first day there was a joint meeting of the Section on Chemical Education and the Division of Physical and Inorganic Chemistry, at which the following four papers were given: A. A. Noyes, chairman, "The Teaching of Physical Chemistry;" W. D. Bancroft, "Physical Chemistry in the Introductory Course;" H. C. Jones, "The Introduction of Physical Chemical Conceptions in the Early Stages of the Teaching of General Chemistry;" J. Howard Mathews, "Some Applications of Color Photography in the Teaching of Physical Chemistry" (illustrated).

In the afternoon the address of Vice-President Frankforter, of Section C, entitled "The Resins and their Chemical Relations to the Terpenes," was delivered before a large audience and was followed by an address by Chairman H. P. Talbot on the subject, "Privileges and Responsibilities of the Chemical Analyst." Following Doctor Talbot, Dr. A. L. Voge, of the Library of Congress, read a paper on "Ostwald's Proposed International Institute of Chemistry."

On Dec. 28, Alexander Smith, president of the society, delivered his presidential address, entitled "An Early Physical Chemist," and was followed by an interesting lecture by Frank B. Kendrick and H. E. Howe, consisting chiefly of illustrations by means of the lantern of the effect of temperature, pressure, concentration, surface tension, osmotic pressure, etc., on reactions in heterogeneous systems.

A feature of the divisional meetings was the symposium on "Mineral Wastes and their Conservation," held before the Division of Industrial Chemists and Chemical Engineers, Dec. 29. The following papers were presented and the discussion was prolonged throughout the day: J. A. Holmes, "Carbon Waste;" W. H. Bassett, "(a) Zinc Losses in Brass Manufacture, (b) Need of Special Alloys for Special Uses;" W. R. Whitney, "New Uses to Reduce Abuses in Conservation;" A. V. Bleininger, "Wastes in the Ceramic Industry;" A. D. Little, "The Abuse of Brand;" F. K. Cameron, "Waste and Conservation of Potash and Phosphoric Acid;" F. G. Cottrell, "Sulphur Fumes and Fluedust;" Charles L. Parsons, "Miscellaneous Mineral Wastes."

It was voted to donate the library of the American Chemical Society to the New York Chemists' Club on condition that members of the society have ready access thereto.

The election of the following officers was announced for 1912: A. D. Little, president; C. L. Parsons, secretary; A. P. Hallock, treasurer; W. A. Noyes, editor of the *Journal* of the American Chemical Society; A. M. Patterson, editor of *Chemical Abstracts;* M. C. Whitaker, editor of the *Journal of Industrial and Engineering Chemistry;* E. G. Love and Alexander Smith, directors for two years; S. W. Parr, W. H. Walker, W. L. Miller, W. D. Bigelow and C. H. Herty, councilors at large; E. G. Love, G. C. Stone and A. E. Hill, finance committee; Wm. McMurtrie, C. L. Parsons and B. E. Curry, membership committee.

Inspiration Consolidated Copper Company

Final announcement has been made of the formation of the Inspiration Consolidated Copper Co., with the details of the financing. The company has an authorized capital of $1,500,000 shares, par $20, and will issue $6,000,000 of 10-year, 6% bonds, convertible into stock at $25 per share. These bonds will be offered to the stockholders of the new company, of record Feb. 1, at par, and will be payable in four equal instalments of $25 each, on Mar. 1, Sept. 1, 1912, and Mar. 1 and Sept. 1, 1913.

The Guaranty Trust Co., New York, and Kidder, Peabody & Co., Boston, have made an offer, good until Jan. 29, to pay $10 per share cash for the 1,000,000 shares of stock of the Inspiration Copper Co., or to exchange for it, stock of the new Inspiration Consolidated Copper Co., on the basis of one share of new stock for two shares of the old; also to pay $40 per share for the 93,750 shares of stock of the Live Oak company or to exchange for it stock of the new Inspiration Consolidated company on the basis of two shares of new stock for one share of old. It is stated that all the stock required to effectuate the offer made by the Guaranty Trust Co., and Kidder, Peabody & Co., also the $6,000,000 of bonds, have been underwritten at par.

The board of directors is as follows: John F. Alvord, Thomas F. Cole, Edmund C. Converse, William E. Corey, Henry B. Hovland, Eugene Meyer, Jr., William G. Rockefeller, John D. Ryan, Charles H. Sabin, Charles A. Corliss, William B. Thompson, Philip L. Foster, William D. Thornton and Albert H. Wiggin. Mr. Thompson is president and Mr. Thornton vice-president. The Guaranty Trust Co., New York, and the Old Colony Trust Co., Boston, are the transfer agents; the Bankers Trust Co., New York, and the National Shawmut Bank, Boston, are the registrars. The new company, it is said, will have about $7,000,000 cash at its disposal and there is believed to be about 45,300,000 tons of ore developed that averages about 2% copper.

The company intends to proceed immediately with the erection of a concentrating plant of not less than 7500 tons daily capacity. It will have an annual output of copper of at least 65,000,000 lb., which it estimates can be produced at a net cost of 8½c. per pound.

November Operations at Goldfield Consolidated

During November, the Goldfield Consolidated Mines Co., produced 28,628 tons of ore, containing $766,351 gross, an average of $26.77 per ton. This was milled with an average extraction of 94.45%, amounting to $25.28 per ton. Total net profit was $510,596, or $17.83 per ton. Development work amounting to 3764 ft. was done.

NOVEMBER COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$1.09	
Stoping	2.47	$3.56
Transportation		0.10
Milling		2.01
Marketing		0.67
General expenses		0.39
Bullion tax		0.26
Construction		0.50
Total cost of operation		$7.49
Miscellaneous earnings		0.04
Net cost per ton		$7.45

At the Clermont the 401 sill was extended and produced 36 tons of ore averaging $58.08. The 413 sill was also extended, producing 235 tons of ore that averaged $53.74 per ton. The 410-X intermediate between the third and fourth levels was driven in $15 ore. The 420 sill on the 750-ft. level was extended east and produced 183 tons of ore averaging $19.43. The 555 drift on the 510 intermediate between the 750- and 900-ft. levels produced 231 tons averaging $13.44. The 521 sill on the 900-ft. level was extended and produced 183 tons that averaged $28.11 per ton. The Grizzly Bear shaft was sunk to a point 20 ft. below the 1300-ft. level and a station was cut for that level.

At the Mohawk the 3-E sill was extended and produced 849 tons that averaged $44.44 per ton. The 3-D sill was also extended and produced 424 tons that averaged $99.63 per ton. The 354 sill produced 118 tons averaging $49.19 per ton. The 345 sill, south of the 354 stope on the 450-ft. level, produced 212 tons that averaged $14.26 per ton. From the 495-ft. intermediate between the 450- and 600-ft. levels was produced 388 tons that averaged $13.23. The 499 drift over the 413 Clermont stope produced 56 tons averaging $21.50 per ton.

In the Red Top the No. 352 crosscut in the 305 drift produced 417 tons averaging $60.56 per ton. The Hazel shaft at the Laguna was sunk 90 ft. below the 718-ft. level. The raise from the first level of the Combination opened some $15 ore. The 402 stope, near the bottom level, was extended downward and produced 802 tons of ore averaging $74.62 per ton.

The Miami District, Arizona

By W. R. Ingalls

Observations respecting four important porphyry mines in which an aggregate of about 66,000,000 tons of ore has been developed, the ore ranging from 1.95 to 2.58% in grade.

Four mines at Miami, Ariz., have been opened on the great deposit of disseminated copper ore that exists in that district. From east to west these are the Miami, Inspiration, Keystone and Live Oak. They are opened upon what is really the same orebody, although there are certain breaks in it, to which I shall refer. The ore is a schist mineralized chiefly with chalcocite. Up to the present time a total of about 66,000,000 tons of ore is claimed to have been developed in the four mines above mentioned.

The Miami Mine

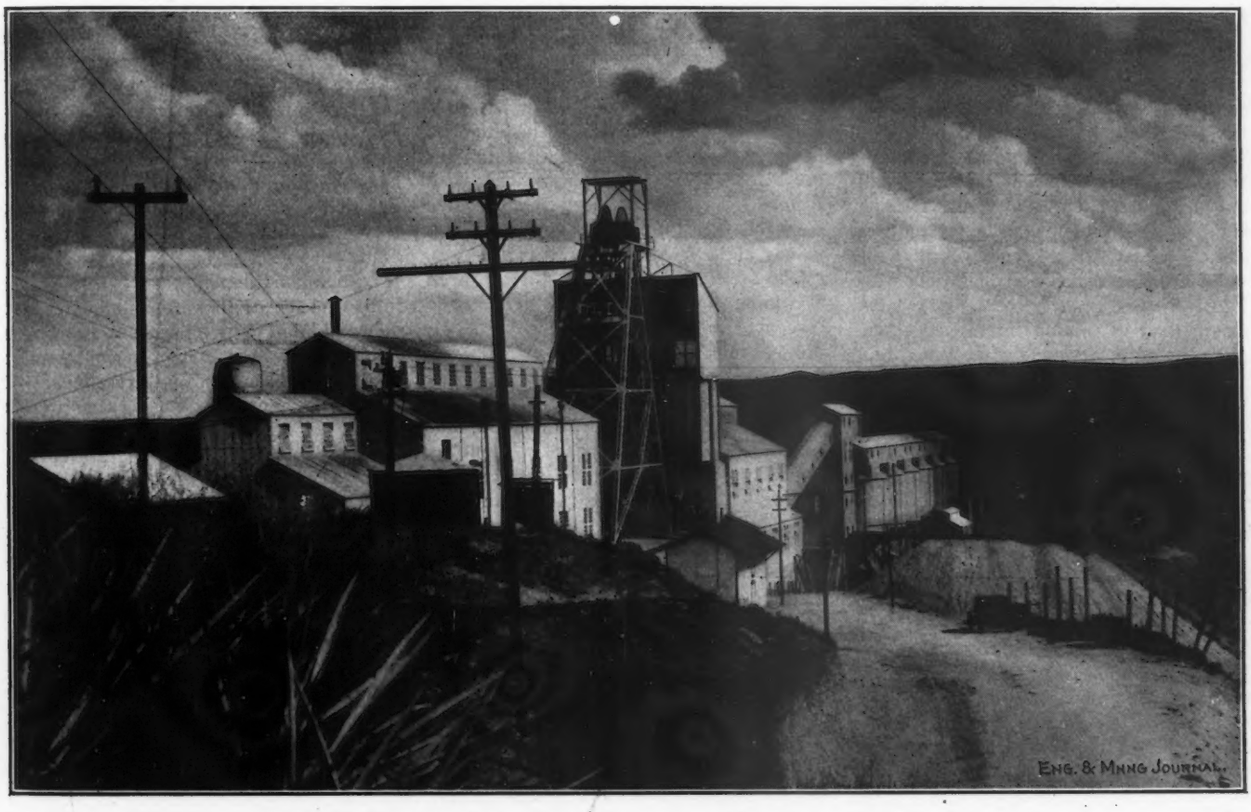
The only producer of the Miami district at present is the Miami Copper Co., which is now mining and milling from 2400 to 2500 tons of ore per day. This is being done with five sections of the mill. When the sixth section is completed and the mill is thoroughly tuned up, its capacity will undoubtedly be about 3000 tons per day. The sixth section will probably be ready for operation by the end of January, 1912. The foundations are ready for two more sections (each of 750 tons capacity), but there is no immediate plan of building upon them. Eventually, one or both of them will probably be completed for the milling of the ore of neighboring companies. With milling capacity for 3000 tons per day, the Miami itself is adequately supplied, in view of its present ore development.

According to the last official report of this company, it had developed 18,000,000 tons of ore averaging 2.58 per cent. copper. Since then no attempt to increase the reserves has been made. It would not be good policy to do so. It may be said, however, that the management expects to add to the reserves both with depth and laterally, and there seem to be sound reasons for such an expectation, especially as to the extension of payable ore to greater depth than yet estimated.

Method of Development

The Miami development has been chiefly by blocking out the ore in the old-fashioned way. In doing this, about 100,000 ft. of drifts, raises, etc., have been run. No other of the "porphyry" mines has done anything like so much of such work in proportion to the volume of orebody. While it is pleasant to learn at other mines that stoping is checking closely with the estimates based on drilling, nevertheless a superior confidence is bound to be felt in development that has put the ore actually in sight. Above the 420-ft. level the Miami has about 8,000,000 tons of ore, a large part of which has already been prepared for mining. If anything, the management has anticipated the requirements of mining too far ahead; in other words, has expended too much money in development in advance of mining. This, however, will all come back in course of time.

The Miami orebody occurs in the form of a submerged mountain with twin peaks. The highest horizontal section shows only two small patches of ore—the two apexes. Succeeding sections show them to be of increased size, until finally they merge together in one great area of ore. The extraction of this orebody has



Surface Plant of Miami Copper Co.

been begun at the top, and at present is being done chiefly by square-setting, the objects being to take out the ore cleanly below the capping and form a thick mat of timber between the capping and the ore in order to keep them separate when the caving is fairly in progress. This system of mining is designed to extract the maximum percentage of ore without dilution, and is performed at a relatively high expense for timber, the expense for which at present comes to nearly 25% of the total cost of mining. The mining of the Miami orebody is, in fact, being done at present under the most unfavorable conditions. Not only must the timber mat be formed, but also all prongs and tongues of ore extending into the capping must be extracted now, if ever. This involves a good deal of relatively costly hand mining, which will disappear when the extraction by caving is fairly in progress.

Cost of Mining

In spite of the relatively unfavorable conditions of beginning the extraction of ore and the operation at only partial (about 60%) capacity, the cost of mining has been lower than was originally estimated, having been only about $1.20 per ton (of which about 30c. is for timber), and there is no doubt whatever that this will be further reduced as operations come into full swing. It is to be remarked that the method of mining introduced in the Miami mine is designed to secure a high percentage of ore extraction, but what this will be has not yet been determined. Of course, it is possible in such mines to extract nearly 100% of the ore, but it may be less profitable to do so than to stop short of such arithmetical perfection.

I will not undertake to describe the mining methods or equipment, which doubtless will be done later by the engineers who are responsible for them. For the present it is sufficient to say that Messrs. Channing, Gottsberger and Lawton have done highly creditable work, both in their planning and in their execution. The mine is so laid out that the ore is delivered through a main gallery, at present on the 420-ft. level, to a large shaft of great capacity through which it is hoisted by compressed-air engines and delivered directly to the mill.

The Miami Mill

The Miami system differs from that of most of the porphyry mines, in that the mill is built right by the shaft, the water being pumped to it, instead of carrying the ore a more or less distance to the water. The decision between carrying the ore to water and water to ore depends, of course, upon the comparative expense. At Miami the cost of water is about 6c. per ton of ore. Such a low figure is attainable only when there is economical use of water.

In laying out the Miami mill, so excellent advantage was taken of a rather difficult and forbidding topography that the result leaves but little to be desired. The ore passes from the bins in the headframe of the shaft to the crushing house, and thence by belt conveyor to the mill proper. In the latter the first crushing is done by Burch rolls, which are followed in some sections by chile mills and in others by Hardinge mills. Originally, one section was equipped with rigid rolls, but although they gave the commonly desired granularity of product, in this case they failed to release fully the mineral, for which crushing to pass a 60-mesh screen seems to be necessary. As between the chile and Hardinge mills, it is rather strongly indicated that the latter will become the favorite.

The pulp is washed on Deister tables. The concentrates run through a tunnel to bins at the foot of the hill. The tailings go to a dewatering plant below the mill, which operates with marvelous efficiency. The total quantity of water required in milling a ton of ore is nine tons; the quantity of new water supplied is only two tons. The dewatered tailings are discharged into a commodious pond formed by a dam across a small ravine. As discharged into it their copper content is not high.

The ore delivered to the mill has been averaging about 2.5% copper. The ratio of concentration has been 20: 1 to 22: 1, the concentrates assaying about 40% copper. The extraction of copper has been about 75%. In spite of the fine grinding to which the ore must be subjected, the loss of copper in slime is low. It is expected that the extraction in milling will eventually be raised to nearly 80%. Considering the character of the ore and the excellence of the mill equipment, it is not improbable that such a remarkably high extraction will eventually be obtained when it has been learned how to operate the mill to the best advantage.

Design and Construction

In the matters of design and building, the Miami mill is at the present time the last word in mill construction. There is no other concentrating mill of which I am aware that has so much purely structural excellence, so much floor space, so much lighting (both by day and by night), so unobstructing a belt, shafting and launder plan and so much cleanliness. Here is a mill in which there is no slop, through which a visitor may go in his best clothes without fear of harming them.

Some criticisms have been directed toward the Miami engineers upon the ground of their apparent extravagance. I use the word "apparent" advisedly, the cost of the Miami mill per ton of annual capacity not having been excessive even when compared to other mills of decidedly inferior construction. But even if some apparently unnecessary outlays were made in the Miami mill, I am, nevertheless, of the opinion that the money was extremely well spent. An addition of 25c. per ton of annual capacity in the first cost, let us say, is very quickly offset by the ability to extract an extra percentage of copper from the ore. This has already been demonstrated in the phenomenally high extraction that has already been made in the Miami mill. The provision of a commodious, well constructed and well kept plant improves the *morale* of the men. Given such a plant they are likely to adapt themselves to its conception, whereas if put to work in an inconvenient, sloppy plant, they are more likely to absorb the spirit of the engineers and themselves become careless.

The Miami mill has been compared to a magnificent mansion, fitted up with appropriate furniture. If, at any time, it may be desirable, it is an easy matter to change the furniture. In the Miami mill the furniture is the machinery and special apparatus. If, at any time, it may be necessary to change the machinery because of alterations in the milling qualities of the ore, or because improvements in the art have led to the development of better forms of machinery, adaptation to either condition is easy in the Miami mill, because of the foresight and broad conception of its engineers. From this point of view the elaborate construction of this mill is not only a direct means of immediately making more money, but also is an insurance against adverse alterations in conditions in the future.

Inspiration Copper Co

Going westward from the Miami, the orebody spreads out, or at least becomes less thick than it is in the Miami, and deflects to the southwest, the general trend being shown in the accompanying map. The orebody is faulted in the Inspiration property, as may be surmised from the peculiar shape shown by the map. Toward the Keystone line the orebody is broken by a fault that has thrown it down in the Inspiration territory and produced an area on the dip of the fault wherein no ore is to be expected. Another fault is known to exist in the neighborhood of the line between the Keystone and Live Oak property. Besides a vertical dislocation at this place, there also appears to have been a heave of the Live Oak orebody to the northwest. The faulting of this district and perhaps other geological conditions have not yet been adequately studied.

Up to the present time the work of the Inspiration Copper Co. has been confined chiefly to prospecting development, which has been both by churn drilling and by underground work, chiefly the former. A good deal of underground work has been

done, but nowhere near to the same extent as was done by the Miami Copper Company.

The developments in the Inspiration have disclosed the existence of an orebody of about 120 ft. average thickness, with a maximum length of about 3800 ft. and maximum width of about 1600 ft. It is estimated that this orebody contains about 30,000,000 tons of ore, averaging 1.95% copper.

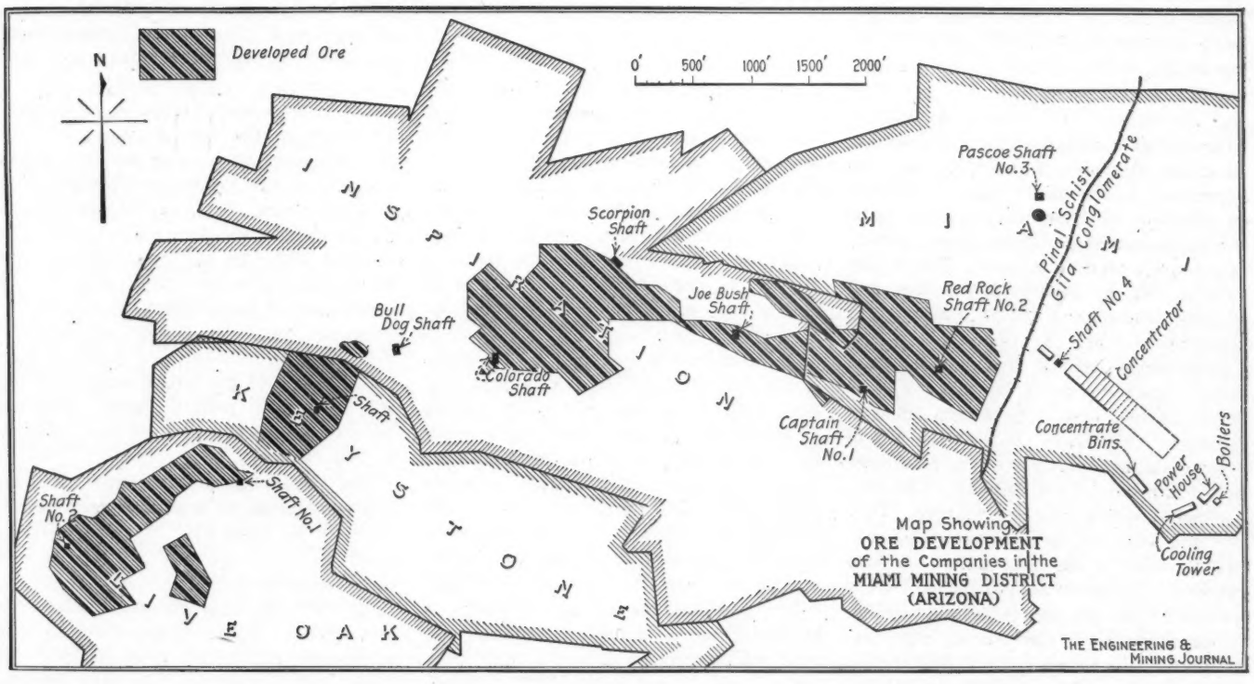
The Inspiration is undoubtedly a very valuable mine, but in comparison with the Miami it is at the disadvantage of a materially lower grade of ore. It follows from this that if the extraction of the ore were to be conducted by the same methods as in the Miami mine, the cost per pound of copper product would be very materially higher. It is likely, however, that the mining of the Inspiration ore will be done by a cheaper method of caving, perhaps by suitable modifications of the methods employed at Bingham and at Ray. This will afford much cheaper ore at the expense of a lower percentage of extraction. I am, however, favorably disposed toward such systems when introduced under suitable conditions, and believe it to be not unreasonable to expect that the extraction of ore may be as high as 83 per cent. Any such result would, of course, go a long way toward offsetting the disadvantage of the lower-grade ore. However, it is not to be expected, not even under the most favorable combination of circumstances, that Inspiration can produce a pound of copper so cheaply as Miami.

A considerable part of the Inspiration orebody is so situated that it can be extracted through an adit level. Just what use will be made of that entry, and, indeed, just what will be the plan for the mining and milling of the Inspiration ore, has not yet, so far as I am aware, been finally decided.

KEYSTONE

Adjoining the Inspiration on the west is the property of the New Keystone Copper Co., which is an interest of the General Development Co. The surface of the country is noteworthy at this place for a remarkable coloration of the country rock by silicate of copper. Unfortunately the copper content of the surface exposures is not sufficiently high to be commercially valuable. The lines of the Keystone property proved to have been laid out in such a way that this company did not secure a large portion of the orebody.

A winze put down from the 250 ft. level to the west of the line beyond which the ore had dipped below that level rediscovered the ore and gave a more correct understanding of its position than was possessed when the earlier work was done on the 250-ft. level. Inasmuch as the sinking of winzes is relatively expensive, recent exploratory work has been confined to putting down churn-drill holes from the surface at the corners of 100-ft. blocks. These have been proving the western continuation of the orebody, but its amount and grade have not yet been estimated. Near the Live Oak line the fault, previously mentioned, may cut off some of the ore, but probably to no great extent. It is reasonably to be expected that about 1,500,000 tons of ore will be added to the Keystone reserves, making a total of about 3,500,000, which may be somewhat increased if the basis of estimating be reduced to 2% copper.



The Keystone mine is favorably situated for operation. The ore seems to grade off into the capping and a high percentage of extraction can perhaps advisably be effected by taking in a little of the capping at the expense of a slight diminishing of the average copper content of the product. The shaft is adequate in size for the extraction of 350,000 tons of ore per annum and from the present outlook the whole orebody can be commanded from the 350-ft. level. The Keystone mine has not sufficient ore to justify the erection of a modern mill, and its ore will probably be treated in a section of the Miami mill that may be added for this purpose. The Miami mill is in view from the Keystone shaft, about 8000

As in the case of the Miami, the development of the Keystone mine has been chiefly by drifts, winzes and raises. It is only recently that any drilling has been done. The underground work was laid out in a thoroughly systematic way, upon two levels, viz.: The 150-ft. and 250-ft. This work has disclosed an orebody about 400 ft. in width and 70 ft. in thickness. At the date of the last annual report of the company, last summer, it was estimated that 2,000,000 tons of ore, averaging 2.25% copper, had been substantially prepared for mining. This ore is in the part of the property adjacent to the Inspiration. In going toward the west the Keystone ore dips downward, wherefore the drifts of the 150-ft. level and then of the 250-ft. level pass out of the ore, into the oxidized capping.

ft. distant and about 350 ft. lower, wherefore the ore may easily be delivered by aërial tramway, right-of-way for which over the Inspiration ground is possessed. The Keystone mine is under the same management as the Miami.

Live Oak

The Live Oak is the most recently developed of the mines of the Miami district, and the work in it up to date has been chiefly prospecting by drilling, although considerable underground work has also been done. A great deal more of the latter will be necessary in order to prepare the ore for mining, in which respect this property is more backward than either the Inspiration or Keystone.

In the Live Oak area the orebody pitches rather sharply to the west and in the western part it lies at a depth of about 800 ft. According to the estimates of the Live Oak engineers they have developed 15,000,000 tons of ore averaging 2.1% copper.

General

So far as known, the Miami district has only one orebody, disregarding its local separation by faulting. This is situated in the flank of the mountain rising from the northern side of "Miami wash," which is a branch of Pinal Creek. This mountain is cut by transverse ravines and valleys, producing a rough and irregular topography. The Arizona Eastern Ry. Co. extended its line from Globe along Pinal Creek 10 miles to the town of Miami, above which the Miami mine is situated. The power plant of the Miami Copper Co. is at the foot of the mountain, at the terminus of the railway. The concentrates loading bins are near-by. Timber and supplies for the mine and mill are elevated to the mine by an inclined railway. The water supply for the mill is obtained from the Old Dominion mine at Globe, whence it is conveyed by pipe line, by gravity, to Burch. From Burch it is pumped to a tank above the mill, the distance being about four miles and the lift about 575 feet.

There does not seem to be any chance that the Miami-Inspiration-Keystone-Live Oak orebody will extend into any other property, except perhaps at the western end, and its existence adds no value to other properties to the north and south in the district beyond creating the hope that a similar orebody may be found. Prospecting up to the present time has given no support to such a hope. As to the western extension there is a suspicion that another fault has dislocated the orebody, and that beyond the Live Oak it is perhaps to be looked for to the north of what would otherwise be the line.

The Miami-Inspiration-Keystone-Live Oak orebody has now been rather closely delimited, but all of the companies will probably add somewhat to their reserves. In this respect the chances of the Miami Copper Co. are perhaps the best.

It is not to be doubted that a consolidation of the four adjoining mines would be of economic advantage. By agreement they have adopted the side-line principle, wherefore no litigation is to be expected, but under individual ownership there will be troublesome mining problems along joint boundaries. There would be economy in capital outlay by concentrating the milling in one plant and there would also be economy in operation. Finally, there would probably be economy in smelting the concentrates. At present the Miami product is shipped to distant Cananea. A better contract was made there than could be made at Globe, only 10 miles distant. It would seem, however, that the concentrates of the Miami district ought to be smelted at home.

Bat Guano

The finding of deposits of bat guano is by no means an uncommon thing, judging from the number of inquiries received by fertilizer makers, and by the JOURNAL. The prospector should understand that size is the first requisite in a deposit; that without the ability to ship large tonnages, say 100 tons or over, the fertilizer dealers do not wish to make contracts, nor will operating costs be low enough to make operations profitable. Next in importance is the question of moisture. A wet deposit is usually a valueless one: first, because on material of the value of guano, one cannot afford to pay handling and freight on the contained water; second, because much of the valuable constituents will probably have been leached out. However, if the deposit is large and labor cheap, it may still be advisable to have the material analyzed.

The valuable constituent in guano is ammonia, and no deposit need be considered which carries under 10 per cent. NH_3. Of subsidiary importance are phosphoric acid and potash. In case the ammonia is over 10 per cent. these compounds should also be analyzed for. In general, however, it may be stated that a material carrying 10 per cent. NH_3 will be worth about $20 per ton, f.o.b. buyers' works. This, however, is conservative, for owing to the fluctuation in the price of "ammoniates," it might be worth $25 per ton. As some bat guanos carry from 20 to 24 per cent. NH_3, the deposit may be worth much more than this.

With small deposits, or moist ones, the attempt should be made to dispose of the material to near-by truck farmers.

The Cape Copper Company declared a dividend, payable Jan. 1, 1912, amounting to $123,323 or 1s. 6d. per share on both its cumulative preference and its common stock.

Zinc Dust in 1911

By William J. Dwyer*

Notwithstanding the facts that prices rose to a high level and that a duty of 1⅛c. per lb. is now collected on importations of zinc dust, the consumption of this product in the United States in 1911 revealed a marked increase. The total consumption was probably somewhat in excess of 2500 tons.

The imports for the fiscal year totaled 2135 short tons valued at $204,836. The average import price per pound, weight and package ex-vessel, port of shipment, was $0.048. As the government did not separately classify the imports of zinc dust previous to Aug. 9, 1909, figures covering a complete previous fiscal year for comparison are not available. According to the "Statistik des Deutschen Reichs, Auswärtiger Händel," the shipments from Germany, the principal source of supply, in 1910 to the United States amounted to 1492 tons valued at $136,749.

Zinc dust was recovered in commercial quantities in the United States in 1911 by the United States Zinc Co., at Pueblo, Colo., and the Grasselli Chemical Co., at Clarksburg, W. Va. The production of the Pueblo smeltery early in the year reached 1000 lb. per day, but later on the output was considerably reduced. The production of the Grasselli company was probably much in excess of its competitor. The recovery of this product, coincident with the broadening markets, will probably receive more attention hereafter upon the part of zinc smelters in this country.

The production of zinc dust in Germany amounts to approximately 10,000 metric tons annually. Upper Silesia produces the bulk, but Westphalia and the Rheinland are also large producers. Belgium is the next important shipper to this market. In September about 17 tons arrived at New York from Austria. A large majority of the American imports came through the port of Copenhagen last year but this material was undoubtedly of Silesian origin. The exports from Germany to all parts during the first three-quarters of 1911 amounted to 2338 metric tons as against 2234 metric tons during the corresponding period of 1910.

Slightly more than 25% of the American import business is done through the port of New York. San Francisco is a large importer.

The principal use for zinc dust is now as a substitute for zinc shavings in cyaniding. Eastern importers, however, find their local markets with sherardizers, dyers and bleachers. The consumption of the product in sherardizing is increasing steadily.

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*50 Pine St., New York.

Mining in Great Britain in 1911

By Edward Skewes*

The production of iron and copper increased; lead decreased and tin remained stationary in 1911. A new blende concentrating mill was started in Cumberland.

*Mining engineer, Ivy House, Lindley, Huddersfield, Eng.

It seems almost an anomaly that nothing was able to injure the coal and iron businesses in any way during 1911. It is a truism that nothing is so shy as capital, yet these industries have marched by leaps and bounds. The Morocco affair, the Diaz resignation, the establishment of republics in Portugal and China, the Tripoli fiasco, and the misunderstandings of Germany and England, would each in ordinary times have been the cause of a setback, yet somehow last year, all combined were powerless. Apart from foreign affairs, there was a railway strike of such a magnitude as never before known. The congestion of traffic thereby caused would, it was stated, continue for two weeks, yet it has continued to the present. There are hundreds of loaded cars in and around the mining and manufacturing centers waiting transit, and strange to relate, some of the railway companies have new lines nearing completion which they are in no hurry to finish on account of not being able to handle the increased traffic. The railway clearing house is establishing "records" weekly, and yet there is an increased demand for cars.

Iron Ore

The iron ore industry had a good year, better than in 1910. During the summer months, business was not so brisk as at the beginning or the close of the year; prices fell, stocks accumulated, and buyers were careful (perhaps on account of the industrial unrest), only to purchase for their most pressing needs, but through December the demand was active, while the price advanced nearly 50c. per ton on Cleveland pig iron within two months. The prospects are now brighter than for many years past. Naval shipbuilding is on a record scale, some of the builders of armaments have four years of continuous work assured, and the construction of ordinary merchant vessels will continue at a good rate for the next two years.

In the Cleveland field, which employs about one-half of the 17,000 miners engaged in the iron mines of Great Britain which report monthly to the Board of Trade, the grade of the ore shows a gradual declining with development, and is now only from 22 to 23% instead of from 26 to 27%. To counterbalance this however, the efficiency of the mines has been proportionately increased by the introduction of electric drills, hand drills and better supervision. December was the boom month of the year. The shipments from Cleveland established a record, amounting to 5700 tons each working day, or double the quantity shipped in December, 1910. The prices for Cleveland pig were also high, about $12.50 per ton; Cumberland and Scottish pig have advanced still more and February delivery prices are on the upgrade. Makers at present are unwilling to enter into any new contracts.

Cumberland and Lancashire have increased the output, but not to any great extent, and the same is true of the Scottish mines. The output for 1910 was 15,226,000 tons; the estimated quantity for 1911 a little over 15,500,000 tons.

Copper Mining

Copper mining was quietly progressive. The principal mines are in North Wales. The precipitate from Anglesey sold for over $150 per ton for a little less than 200 tons. The copper from Cornwall and Devonshire, a byproduct, was almost negligible. Two new mines began operations last year; one at Alderley Edge, Cheshire, and the other in the North Riding of Yorkshire. The output for 1911 was 46,500 tons.

Fluorspar mining was confined principally to South Durham and Derbyshire, and the probability is, that there was a serious decrease from the 61,621 tons of 1910, as some of the mines were idle, as the result orders from the United States were not forthcoming.

The year 1911 saw the successful working of the most uptodate mill for the concentration of blende in England. It has a capacity of 200 tons per 12 hours, and was designated and constructed by German contractors for a mine in Cumberland. The blende mines are situated in the north of England and north Wales. Derby yields about 600 tons per year. The output was stationary as the increase in Cumberland was counterbalanced by the decreases elsewhere.

For the first time in the history of the china-clay industry has the output reached 800,000 tons, an increase of nearly 25,000 tons over 1910, and this output would have been greater if sailing vessels had not been prevented by storms from sailing during the last quarter. Prices have also ruled higher, and the pay of the laborers increased. China stone output remains stationary at about the 70,000-ton mark, as the Norwegian feldspar is a keen competitor and much cheaper.

The price of wolfram ore at the close of the year was about $500 per ton, a decrease of $50 from the beginning of 1911. The output was 300 tons, estimated. There were attempts made to float companies to mine for uranium and radium, yet the only source of supply in England was from the Saint Ives mines, Cornwall.

The Royal Mint after a series of extended experiments rejected coal and coke for the furnaces and is now using gas with a special burner. The testing plant of the mines department, Royal School of Science, was completed, and it is now one of the most complete in existence. Tests can be made on all kinds of ores. The rooms in which the crushers, stamps, pans, are fixed are all well padded, to deaden the noises.

Lead Production Decreased

The output of lead ore in 1910 was 28,534 tons. The output for 1911 did not exceed 25,000 tons. The lead mines are scattered. Derbyshire heads the list of producers. Mill Close mine, Darley Dale, is worked on a larger scale, and employs more labor than any other lead mine in England. All the machinery is uptodate. The Weardale Lead, Rookhope, Durham, can be classed among the largest producers, and owes its renewed prosperity to lateral oreshoots. The Greenside mine, Ullswater, Westmoreland, maintains its output, and is continually adopting improvements underground and at the surface, to meet the changing character of the ore. The Thornthwaite mine, Keswick, is making some needed changes to increase the output and the method of impounding sand and slime is really good and on a large scale. The Flintshire mines showed a decrease. The outlook is dark for the Shropshire mines, and not optimistic for Cumberland or Westmoreland.

The most important of all the lead-mine developments was the completion of the Milwr adit in Flintshire, which is over two miles in length and drains the water for a depth of 900 ft., although, the idle mines on its course are only 600 ft. deep. This should give an impetus to lead mining. One of the most painful events in the history of English lead mining was the closing of the Great Laxey, Isle of Man. Its overshot water

wheel was a great attraction to the thousands of yearly tourists.

Black Tin

The principal events of the year have been the completion of Williams' shaft, Dolcoath, at a cost of considerably over $500,000; the installation of an uptodate tube mill at East Pool; the appointment of an Australian engineer to the management of Carn Brea, and the subsequent resignation of the chairman, directors and secretary: the ever-increasing use of electricity supplied to the mines by independent power companies; the extension of the magnetic separator and consequent higher price for the concentrates; the Royal Mines Commission to investigate all the principal mines; the lowering of the death rate due to miners' phthisis; the successful working of the largest suction dredge; not to mention the bitter feelings of the miners against some members of the Metal Exchange, who, it was said, were about to penalize unduly such impurities as wolfram, antimony and arsenic.

Effect of High Price of Tin

The year 1911 was good, the price, which averaged in 1910, $515, advanced to $563.75, taking the ticketing sales as a basis. The mines that paid dividends increased from three to seven and the amount of dividends proportionately. Dolcoath paid 12½ instead of 6¼% and South Crofty paid 25c. quarterly. The quantity of black tin sold in 1910 was 7562 tons; last year the output was practically stationary, the mines have produced less, but the quarries and surface works more.

Three suction and one bucket dredge were at work, but the quantity of black tin recovered did not exceed 70 tons, on account of the difficulties of adopting the dredges to local circumstances. The future of the dredging for tin is encouraging, and other dredges will be built to work Restrouget and other creeks during the coming year.

The Mining Industry in Germany

By O. H. Hahn*

The lower Rheinland and Westphalia district is the largest iron producer. Upper Silesia furnishes 82% of the zinc. Tin comes from two places in Saxony. Copper and lead mining has declined in recent years.

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Conforming to geographical position, the German iron industry is generally dealt with under the following sections: (1) The lower Rhein country and Westphalia; (2) Siegerland and Nassau; (3) The country about the Saar; (4) Luxemburg and Lorraine; (5) Upper Silesia; (6) Scattered districts.

Lower Rheinland and Westphalia enjoy the most favorable situation as regards fuel and transportation; for an ore supply they have to draw on outside districts, as the black-band ore found in their coal mines is insufficient in quantity to support a large industry. It is stated that the ore charge of the iron furnaces in this district consists of 52% of foreign and 48% of German ore. The foreign ore comes, for the most part, from Spain, *via* Antwerp and the river Rhein; the next in importance from Sweden by way of the port of Stettin and the state railways.

Siegerland and Nassau produce excellent manganiferous spathic-iron and hematite ores, also manganiferous limonites, part of which are smelted at home; the larger portion is, however, sold to the preceding district and to upper Silesia, where it is used for the manufacture of spiegel. The Saar district produces limonite, and also *minette*, a peculiar brown-iron ore predominating in Luxemburg-Lorraine and parts of France. Luxemburg and Lorraine are the countries *par excellence* for *minette*, which is found there in such abundance that it not only supplies the home iron works, but also furnishes the largest percentage of the German ore in Rheinland The *minette* is not rich in iron, the average probably not exceeding 30% Fe. The Saar and the Luxemburg-Lorraine districts taken together nearly equal Rheinland-Westphalia in production of pig iron according to the statistics published by the Verein deutscher Eisen-und Stahl-Industrieller.

Upper Silesia's Iron Trade Declining

Upper Silesia is dwindling into insignificance in the production of pig iron as compared with the preceding districts and its output of iron ore has been falling off from year to year. Neither its iron ore nor its coke is of desirable quality and its industrial enterprises are struggling hard against what they believe to be unjust freight rates on the state railroads. The scattered districts comprising Bavaria, Saxony, Würtemberg, Thuringia and the seaboard towns rank about the same in percentage of production with Silesia.

Bavaria discovered not long ago that it possesses in its confines quite an extensive bed of limonite ore in the Franconian Alb. Its average assay is 38.5% Fe with small quantities of P, S, Zn. As and Cu, but unfortunately 22%, SiO_2 Germany's total production of pig iron amounts to nearly 15,000,000 tons, of which Rheinland-Westphalia furnishes in round numbers about 43%, Siegerland and Nassau, 5% Saar and Luxemburg-Lorraine 38.6% Silesia 6.5%, and the scattered districts, 6.9 per cent.

The improvements made from year to year in the iron industry consist chiefly in the utilization of blast furnace gases for power purposes and the heating of Martin and other furnaces, also in utilizing blast-furnace cinder for the manufacture of cement and building stone, briquetting of ore and metallic chips, sintering ore, etc.

To quiet the German consumers of tin-plate, who have been clamoring for the abolition of the duty on their material on account of the inability of the home industry to fill their orders there are two more tin-plate mills going to be erected shortly, viz.: one in Silesia and another of 20,000 tons capacity at Wissen, Rheinland.

The ores of manganese needed for the production of spiegel and ferromanganese are mostly imported from Russia, Brazil, India and Greece. The German mines of manganese are scattered all over the country and thir output which is small is mostly sold to chemical factories in America. The ore imported amounts to 500,000 tons while only 5000 are exported.

Mansfeld Co. Biggest Copper Producer

The largest producer of copper in Germany, the Mansfelder Kupferschieferbauende Gewerkschaft, has just shut down two of its hoisting shafts near Eisleben and is going to dismantle them for the reason that this part of its concession is exhausted. The company is, however, keeping up vigorous prospecting on its ground and is taking up extensions on adjacent land. In November, 1911, while boring a hole to find the copper schist, it struck a big deposit of rock salt which overlies the potash salts. The same company, which owns coal mines in Langendreer, Westphalia, and is making its own coke there, purchased more coal lands near Hamm and started sinking two shafts on its new acquisition. Out of a total of 37,000 tons of copper which Germany produces the Mansfeld company makes 20,000 regularly.

The center of gravity for zinc is upper Silesia which produces about 82% of all the zinc ores of Germany. Notwithstanding the excessive freight rates it is also getting 14% of the Australian ores imported. In the way of improvements in the reduction of ores it does not lag behind Rheinland. In the course of the last year reduction of zinc ore in the Imbert-Fitzgerald electric furnace has been carried on experimentally at Hohenlohehütte. The Savelsberg shaft-furnace is also reported to have given good results and it is now being tried on a larger scale. There is nothing extraordinary to be recorded on lead and the reduction of its ores.

Tin ore is mined at two places in Saxony. At Altenberg the loose rock from a caved-in mine assaying 1/3% in tin is hoisted through a shaft in solid rock and concentrated to 60% tin in a dressing works with partially antique and partially modern machinery operated by waterpower. The *schlichs* are calcined to get rid of arsenic, which is saved in flues, and leached with hydrochloric acid for bismuth. The schlichs are then sweetened by washing, dried and smelted in a primitive little blast furnace with charcoal and old slag. The resulting slag is sold to a metallurgical establishment for the tungsten and molybdenum it contains. Everything is done at as cheap a scale as possible and all the incidental products are turned into money to make a little profit. The actual output of tin is not made public. The Goldschmidt works at Essen is treating Bolivian ores entirely.

Potash Situation

There are now 77 companies in the potash syndicate including Aschersleben and Sollstedt on whose account the obnoxious potash law was enacted by the Reichstag. In spite of this law new potash mines are springing up every day, only they will get into trouble when they apply for a license to put up a chloride of potassium factory. In November of last year the erection of five such factories was forbidden by the licensing commissioners of the town of Merseburg because the projectors proposed to run their waste liquors into the river Saale and would thus pollute its water. The city of Magdeburg which gets its drinking water from the river Elbe has several suits going on now against chloride of potassium factories for pollution of its water. Indignation meetings are held by farmers, manufacturers and others to protest against the potash men running their waste liquors into the rivers. So, they will have to put up evaporating plants, but what is to be done with the residues? That is another troublesome problem.

Mining in Jalisco in 1911

By Austin C. Brady*

Developments of hydro-electric power will soon make possible the profitable operation of mines from which only smelting ore was formerly shipped. Mills are planned for concentrating the low-grade ores.

*Guadalajara, Jalisco, Mex.

The state of Jalisco was particularly free from disturbances during the period of the Madero revolution. Shortly before the signing of peace terms some armed bands made their appearance, but none of the mining camps were molested. No serious labor troubles occurred after the revolution. Some enterprises were affected in a financial way as a result of the disturbed conditions of the year in the republic.

Hydro-Electric Power From Santiago River

The Chapala Hydro-electric & Irrigation Co. completed its Puente Grande power plant, which will furnish power to the Etzatlan and Hostotipaquillo mining districts, and will supply any other transmission lines that may be built. It is on the Santiago River, 15 miles from Guadalajara, and represents a cost of over 3,000,000 pesos. The present capacity is 12,000 hp. The Etzatlan-Hostotipaquillo transmission line was ready for service early in the year, and since March the company supplied power from its Juanacatlan plant. The insulating system proved inadequate during the last rainy season, and will be changed.

The Amparo Mining Co., operating in the Etzatlan district, continued to pay dividends of 3% quarterly on its capital of $2,000,00. The 1911 showing probably was not so good as that of 1910, due to the power failures of the Chapala company in the rainy season. Recently two additional tube mills were placed in commission, and the company is now handling more than 1000 tons additional monthly. Development on the lower levels of the mine were attended by satisfactory results.

Hostotipaquillo District

Early in the year the famous old Mololoa mines in the Hostotipaquillo district were purchased from W. M. Mathews by the Makeever syndicate of New York, operating the El Favor and El Tajo properties in this state. After the purchase, development was pushed, and a big tonnage of high-grade ore shipped to the smeltery. At present 300 pack animals are in service carrying ore from Mololoa to Magdalena, the Southern Pacific shipping station. The treatment of Mololoa ore at the El Favor plant was commenced, and a high extraction obtained by direct cyaniding.

During the first half of the year much high-grade ore was shipped from the Casados mine of the Consolidated Mining Co., in the Hostotipaquillo district. The property is now under option, and attention is being concentrated on development. The year's development was extensive, and a big tonnage of milling ore was proved. It is probable that the mine will be purchased early this year.

The El Favor Mining Co. suffered from power interruptions during the rainy season. The milling of El Favor ores was suspended pending the development of sulphides, which are free from manganese, and in the meantime the plant will run on ore from Mololoa. Rich orebodies were opened in stoping on three of the upper levels, and shipments to the smeltery are in progress.

The Cinco company, controlled by the Marcus Daly estate, and owning the old Cinco Minas property in the Hostotipaquillo district, operated only a part of the year. Present development is being done with the object of proving the orebodies at depth, and it is probable that plans for a mill will be considered early in 1912. Large blocks of milling ore have been opened since the Daly estate secured control. The purchase of the mines for 500,000 pesos was made in January, 1910.

A lease on the reduction plant built by the Virginia & Mexico Mine & Smelter Corporation in the Hostotipaquillo district was arranged by the Espada Mines Co. early in 1911, and an aerial tramway to carry Espada ores to the mill was constructed. Milling will be commenced shortly. Power will be furnished by the Chapala company over a branch transmission line from the El Favor transformer station.

Disturbed conditions interferred with the plans of the Amajac Mines Co., and operations were suspended for several months. Mine development is now being resumed, and the uncompleted work of remodeling the old Amajac reduction works in the Hostotipaquillo district will

be taken up later. The Mina Grande Co., controlled by French interests, carried on development work during the year, and reopened some of the old workings of the Mina Grande at depth. During the current year the question of reduction facilities will be taken up. The La Dicha Mining Co., another Hostotipaquillo-district company did development work during the greater part of the year, and is now planning to build a mill.

Operations Near Ameca

Financial plans of the Magistral-Ameca Copper Co., owning the Magistral mine and concentrating plant in the Ameca district, failed as a result of the political upheaval, and for several months work was at a standstill. Recently the sinking of the shaft was resumed. The company expects to adjust its affairs for extensive operations in 1912. The bond, held by E. A. Montgomery, of Los Angeles, Calif., on the Zapote mines in the Ameca district, was extended during the year, and a shaft that is expected to prove the copper deposits of the Ameca district at depth is being sunk. The bond price is 100,000 pesos. Late in the year the Almoloya Mining Co., of Mexico City, bought the old Cerrito mine in the Ameca district for 50,000 pesos, and new development at this property is now in progress.

The Regina Mining Co., operating at San Martin Hidalgo, in the Ameca district, accomplished much successful development during the year, and is now ready for a concentrating plant. The Regina is the successor of the Philadelphia Copper & Gold Co., which commenced operations several years ago, and a big tonnage of copper ore awaits reduction facilities.

During 1911 the Tajo Mining Co., operating in the San Sebastian district, increased the capacity of its reduction plant, and made a big cut in the cost of delivering ore by a system of chutes and trams. Regular shipments of bullion were made.

Other Districts of Jalisco

The Mexicana Mining Co., a subsidiary of the Keystone Mining Co., of Shamokin, Penn., resumed operations at the Keystone properties in the Tapalpa district. Mine development was started in August, and later concentrating was commenced. The San Miguel Gold Mining Co., of Indianapolis, steadily developing properties near Ejutla, and imported machinery for a concentrating and amalgamating plant. The Lupita Mines Co., in the Mascota district, the Carrizo Copper Co., in the Ayutla district, and the Navidad Reduction & Mines Co., in the San Sebastian district, operated on a limited scale.

At the famous old Bolaños mines, in the Bolaños district the Mexican Mines Co. did some work in the upper levels. After the close of the rainy season the company took up vigorously the work of building a wagon road from the camp to Colotlan, at which point it will connect with a stage road to Zacatecas. With the completion of this road the company will be able to take in the heavy pumping machinery necessary for the unwatering of the lower workings of the Bolaños mines.

The Cyanide Industry

By William J. Dwyer*

A dull and monotonous year characterized the cyanide industry in 1911, but so far as ascertainable the consumption of both the sodium and potassium salt are about equal to that of the previous year. The imports for the fiscal year were about 48½ tons less than those of the corresponding year. A better inquiry was noted in the fall. While cyanides are manufactured in this country by several firms the foreign markets are still the chief source of supply and the imports are generally regarded as a safe criterion of market conditions. The average value of the imports, weights and package, ex-vessel, port of shipment, in 1911, was 14c. per lb.; in 1910, 13½c. per lb.; in 1909, 14c. per lb. The duty is 12½%. The imports of potassium cyanide in short tons since 1903, the earliest figures obtainable, to date are shown in an accompanying table.

POTASSIUM CYANIDE IMPORTS

Year	Tons
1903	1,509.7
1904	756.9
1905	812.1
1906	1,054.3
1907	1,535.0
1908	1,664.1
1909	1,376.4
1910	1,211.3
1911	1,163.6

Statistics covering the imports of sodium cyanide are not tabulated as most of this salt is sold as high-percentage potassium cyanide. Of the 1911 imports of potassium cyanide 1087.9 short tons valued at $304,359, or about 93% of the total imports, were brought in through the port of New York. The trade is in the hands of two firms representing German and English interests. One of the importers is likewise the largest domestic producer. Prices of both sodium and potassium salts remained unchanged throughout the year at 18c. per lb. in carload lots.

Hans Foersterling of the Roessler & Hasslacher Chemical Co., the largest domestic producers of cyanides, was granted patent No. 999,215 on Aug. 1, covering a composition of matter which will easily generate halogen cyanides in connection with an oxidizing agent. The process calls for the melting of molecular proportions of sodium cyanide and sodium bromide, which are allowed to solidify. This double salt is used instead of the mixture heretofore used consisting of sulphuric acid, sodium bromide, sodium bromate and cyanides. An oxidizing agent of a 25% hydrogen-peroxide acid solution is added. Bromocyanide is rapidly formed and the bromine is taken up by the hydrocyanic acid. It is proposed to furnish the mines with a ready-made, correctly proportioned mixture of alkali halogen with cyanide, "all that is necessary being to dissolve a certain amount of double salt and add an oxidizing agent." The inventor claims that the largest part of the alkali halogen is not lost in general mill work and it is only necessary to add so much alkali halogen to the cyanide as has been actually lost.

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Cyanamide

Calcium cyanide was produced during the year by the American Cyanamide Co. at its plant in Niagara Falls, Ont., just across the Canadian border. The use of the product, almost exclusively for fertilizer purposes revealed a marked increase. The consumption of calcium cyanamide in the United States up to the end of the fiscal year was 5617 short tons valued at $295,545 comparing with 764 tons valued at $40,091 consumed from Aug. 6, 1909 to June 30, 1910. The perfecting of the Clancy process of treating gold ores promises a new outlet for the product.

Molybdenum in 1911

Special Correspondence

An active demand for molybdenum from England in 1911, stimulated investigations, but the output as far as the North American sources were concerned was very small, the most important production coming from one of the eastern states. A deposit of molybdenite in eastern Chihuahua, Mexico, was unworked because of the political disturbances. Several tons of high-grade concentrates were shipped from there in 1910. The Canadian deposits in Quebec and Ontario were exploited in a small way but with no resulting output of importance.

Various scattered deposits in the western part of the United States yielded small tonnages. A discovery of molybdenum oxide in southwestern Colorado was reported but not exploited. Successful experiments with the concentration of molybdenum ore were made in Denver. An important use for molybdenum is in connection with the making of armor plate.

Igneous Concentration of Zinc Ore

By F. L. Clerc*

Suggestions respecting the use of the Wetherill process, simply reducing and burning the zinc, as a method of concentrating zinc ore; the oxide product to go to spelter furnaces.

*Metallurgist, Boulder, Colo.

In presenting the subject of igneous, or pyrometallurgical, concentration of zinc in lean ores, for the production of a raw material for spelter making, I am not suggesting anything that is new or untried. This method of concentration has long been practiced, both incidentally, that is, in connection with processes carried on for other products, such as zinc pigment direct from the ore, and spiegeleisen from the franklinite residuums, although in these cases, the spelter is really a byproduct; and intentionally, when under peculiar conditions plants designed to produce zinc pigments, have been run as simple concentrators, and their entire output has been made into spelter. Thousands of tons of zinc ore have been treated in this way.

Fire concentration has also been advocated from theoretical grounds. It is urged that since it costs three times as much to put ore through a spelter furnace as it does to put it through an oxide furnace, there will be a saving equal to the cost of putting one ton through the spelter furnace, if three tons can be put into one, by a preliminary concentration in the oxide furnace. My reasons for returning to this old subject may be classed under two headings, economic and technical.

Economic Reasons for Igneous Concentration

On the economic side are to be considered the large deposits of lean ores, known to exist, which cannot be profitably treated by any other known mechanical or chemical method, and the inaccessibility of other ores, which are fairly susceptible to mechanical concentration, but yet cannot be brought to the richness which will stand transportation to market. The distance they can be transported depends largely on their zinc contents. The last economic condition I shall mention is the wonderful development of the smelting and mining industries, and the large amount of capital profitably engaged in them. One result of this condition is that projects, which were once thought chimerical, because of the expense of installation, are now seen to be justifiable, because they can be shown to be profitable.

Fire Concentration in Special Plants Untried

It is, however, the technical side of the question which I wish to emphasize. I know of no instance where fire concentration has been tested in a plant designed especially for that purpose. I think this test should be made, and that conditions are favorable for making it at the present time. The recorded experience, bearing on this subject, is so extensive, that I cannot do more than indicate the lines on which it has accumulated.

It is for the reason that I am convinced of the economy of fire concentration, in certain cases, that I wish to record this strong disclaimer: I do not believe, that, in any form, it is applicable to all ores, or that it will ever displace either mechanical or chemical concentration, where they are effective.

Igneous concentration is only practicable where a considerable tonnage, for a term of years, is assured. I have elsewhere called attention to the apparent paradox, that the richest concentrates sold in the open market come from ores of the Joplin district, which, as mined, are probably the leanest of any ores profitably worked for zinc, anywhere in the world.[1] This shows what can be done by mechanical concentration under favorable circumstances. Machinery can be moved, furnaces and buildings cannot.

Indicated Lines of Development

In looking into the subject of igneous concentration, two lines of development may be profitably studied, viz.: the manufacture of pigments[2], and the removal of valuable fumes from furnace gases[3], if concentration is kept in view as the definite object. Current practice in the manufacture of sublimed pigments may be represented by the Wetherill oxide furnace[4], the Lewis-Bartlett sublimed white-lead process[5], and the F. L. Bartlett zinc-lead process[6].

I will briefly indicate some modifications to adapt them to igneous concentration. The Wetherill oxide furnace is too well known to require description. For igneous concentration, I think that each pair of connected furnaces should be connected with the common overhead flue by its own iron uptake pipe. This uptake should have a sliding damper by which the two furnaces can be isolated from the others during the operations of drawing and charging with the object of excluding, as much as possible, an excess of air. This construction is found in some modern works, for the above and other reasons.

I think the furnaces could be made wider, and the thickness of the charge greater, and that the furnace can be run hotter, when the color of the concentrate is not important. From experience gained with the other processes mentioned I think it is advisable to admit a current of hot air above the grate. This additional air will be drawn from outside, will pass over the arch covering the grate, thus cooling it to some extent and prolonging its life, and under a higher arch sprung over it.

The grate bars must be protected from excessive heat to prolong their life. Since water is undesirable in the ash pit, this result may be effected by water-cooled grate bearers. Mechanical devices for bringing the charge to the furnace, and for carrying away the cinders, readily suggest themselves.

But I can think of no mechanical device, for spreading the charge on the grate, which will not force too much of the smaller pieces through the openings into the ash pit.

The Lewis-Bartlett Process

The history of the Lewis-Bartlett process is interesting. It was the natural outcome of treating oxidized zinc ores containing lead at Birmingham, Blair County, Penn., where there was a small Wetherill oxide works. The ores came from Sinking Valley, nearby. The sublimed pigment was given a thorough test, and found to be satisfactory. Further tests were made in the vicinity of Philadelphia. When it was applied at the Lone Elm works, at Joplin, Mo., the results were disappointing. As Mr. Lewis expressed it to me, "they had all of the sulphur to handle, and only a part of the lead and zinc to take care of it." The product was "as black as your hat." But success was achieved by making a two-stage operation out of a direct operation. The blue fume was revolatilized in a modified form of the single-tuyere slag-eye, long used at Granby, which was originally built of stone on three sides, with a sheet-iron breast, and was lined with brick. The modifications, and the latest form, are fully shown in the articles referred to.

But the blue fume, in addition to being black, was so light and powdery that it could hardly be shoveled. It was accidently discovered that it would burn, if ignited. In a layer a few inches thick it

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[1] *Trans.* A. I. M. E., Vol. XXXVIII, p. 320.
[2] "Lead and Zinc Pigments," C. D. Holley.
[3] *Trans.* A. I. M. E., Vol. XLI, p. 631.
[4] "Metallurgy of Zinc and Cadmium," Ingalls; p. 159.
[5] Eng. and Min. Journ., July 4, 1885.
[6] "The Mineral Industry," Vol. V, 1896, p. 619.

would continue to burn without apparent flame. The fire spread slowly but indefinitely, and left behind a bed of ash-like material, which was heavy, granular, and easily handled. This burnt fume was treated, with the gray slag from the American hearth treating unroasted galena, in the modified slag-eye, and a notable amount of oxidized lead ore was often added to the charge. An innovation in the bag rooms was the substitution of woolen bags for cotton. Another was, the suspension of the bags above nipples in the top of hopper-shaped bins, into which the fume was shaken down. An important improvement in the slag furnace was the use of water-backs, and the introduction of a hot blast at the top of the furnace, in addition to the usual blast. In the earlier forms used, the walls and lining of the shaft did not break joint with the four corner pillars, but were built in between them, so that with the water-backs in place, they could be renewed without disturbing the supporting pillars. In recent years, more secrecy has been maintained about the operation of these works, and a large proportion of their output has been paint.

It is from the apparatus employed in these works, rather than from the process, that anything bearing on igneous concentration can be borrowed. It is quite remarkable that the diminutive blast furnace produced, in addition to its sublimed product, a considerable amount of hard lead, and a distinct matte, which could be separated in the slag pots.

F. L. Bartlett Process

The F. L. Bartlett process is described by the inventor in "The Minera Industry," Vol. V, page 619. It is remarkable, I think, for its flexibility; the ease with which it can be adapted to changed conditions; the capacity of the furnaces in proportion to their cubic contents, and for the short distances within which the reactions take place. It is essentially a three-stage operation.

The sublimed product is heated to expel entangled gases and slightly held volatile products. In this connection I may record an experience in the Lehigh zinc works, at Bethlehem, to enforce the importance of strongly heating any sublimed product, which has to be subjected to a second melting, or to be shipped.

In the early days various means were tried for compressing the light bagroom oxide so that it could be packed, 400 lb. to the cask. Among the devices used was a pair of heavy edge rollers, built up like millstones, which revolved in a pan like a pair of chilean rolls; they were soon discarded. The squeezer afterward employed passed three sacks containing bulky oxide, resting on a roller-carried table (whose motion could be reversed), backward and forward under a revolving wooden drum. By suitable levers, this table was pressed more and more strongly against the drum, until as much as possible of the gas was forced out through the mesh of the bags. The flattened bags were so hard that thumb pressure would make a scarcely visible impression.

Prior to 1878 the oxide treated in the spelter works came from the flues and floor sweepings, and was heavy and granular. When it was decided to smelt the bagroom product, a problem was faced. From laboratory experiments it appeared that it was only necessary to heat the oxide until it became bright yellow (showing a dull red in the dark). It was, therefore, shoveled into the lower hearth of a short two-story reverberatory kiln, used for roasting small sizes of calamine. The immediate effect was striking, if not alarming. The pile shrank visibly to a fraction of its original bulk, and the men hurried to get it out, lest it should all disappear. Almost as fast as it could be pushed forward to the bridge wall and pulled out at the front door it was discharged in a satisfactory condition for mixing with coal and charging into the spelter furnaces.

This practice was regularly followed thereafter. Twenty years later I was told that it was in use at the small works which ran for a few years at Friedensville, having been introduced by a workman from Bethlehem, only four miles away. It was supposed to have always been practiced. Nevertheless it had to be learned in the school of experience many years later at the Globe works, Denver.

Device for Heating Sublimed Dust

Some form of heating sublimed concentrates has been found essential for their subsequent treatment. The following device is suggested. A conveyor belt, made up of short lengths of sheet iron linked together by steel belt hooks with the sides turned up to form a rim, can be continuously fed with a shallow layer of the sublimed concentrate, and dragged through a heated chamber over hexagonal or pentagonal drums outside the chambers. A little of the fume or clay without grit under the belt will prevent excessive wear and friction. Neither the length of the furnace nor the time of exposure required is considerable.

I have avoided the subject of the treatment of mixed sulphides for the reason that each case requires a special treatment. A concise and comprehensive review of this subject can be found in a paper by W. R. Ingalls, presented to the Canadian Mining Institute, in March, 1911, under the title of "The Problem of Mixed Sulphide Ores."

I have only this to say about pyritic smelting[8]: much may be expected from it if concentration at the top of the furnace becomes the principal object in running it. From furnaces which may be adapted to produce an igneous concentrate, I can now turn to the apparatus for collecting it. Fortunately, there is abundant testimony to the efficiency of woven fabrics in straining out solids from gases, and much published experience as to the best materials for various uses, the temperature the bags can stand, their length of service and the care and treatment they require.

I shall confine my suggestions to the functions and construction of the settling chamber. This organ was once thought necessary in zinc-oxide works, but it has been almost suppressed in the more recent works. I think it can profitably be revived in such a form as to hasten the cooling of gases, and relieve them of all the fume they can be made to drop. If a considerable deposit can be collected here, the life of the bags will be prolonged, and a moderate straining surface will suffice for a considerable daily output.

Use of the Settling Chamber

The function of the settling chamber is to collect as much of the sublimed zinc oxide as is practicable, and in this way diminish the extent of straining surface required in the bagroom, and avoid the more expensive handling of oxide collected in bags. With this object clearly in mind, the conditions which affect the rapid settling of the oxide can be profitably studied. And the conditions which are found to be favorable should control the design of the settling chamber.

The principal conditions which are known to favor the deposition of solid particles, carried along by moving gases, are as follows: (1) The cooler the gases are the more rapidly will the particles settle. The gases should be cooled as promptly as is practicable. (2) The walls of the chamber should be cooler than the gases, for solid particles, which have the property of coherence, in consequence of which larger aggregations called flakes are formed, will join when they are brought near together and their relative motion diminished by the obstruction a wall offers to this motion. There is a tendency in solid particles to stick to a cold wall, while they are repelled from a hot one. (3) Even the finest particles suspended in gases, which show little coherence or tendency to form flakes, can be deposited upon a surface against which the gas rubs, and a cold wall is more favorable than one which repels. (4) Owing to the small weight of the individual particles, the vertical component of their motion due to gravity, which pulls them down, is small, compared with the motion imparted to them by other forces also acting on the moving gases. So that in spite of their greater density, the deviation of their trajectory from the mean path of the lighter

[7] Eng. and Min. Journ., July 29, 1911.

[8] "Principles of Copper Smelting," Peters, pp. 213 et seq. "Practice of Copper Smelting," Peters, pp. 230 et seq.

gases, in a small period of time, is small. Conversely, the time required to fall through a certain distance is both apparently and actually increased. In a vacuum the smallest particle would fall in the same time as the largest.

But the viscosity of the gas, acting to resist any displacement of its particles, added to its inertia which also resists displacement, increases the work to be done by gravity, and therefore increases the time required to move a given weight vertically through a given distance. The surface friction of the small particles, which is generally assumed to account for the slow fall of such particles through still or moving gas, appears to be rather the intermediary by which viscosity and inertia can interact with gravity to produce equilibrium of motion.

Long Flues Promote Settling

It is better to say that the less the deviation of the solid particles from the mean path of the gases, the longer must be the course of the gases in order that the particles may settle through the required distance. This way of looking at the problem brings out the direct connection which exists between the velocity of the fume-carrying gases and the distance they must travel to allow the fume to settle out of them. But a limit is soon reached in the practical length of settling flues. It is imposed by the cost of construction and maintenance, and enforced by the working expense involved in gathering up the fume, spread over a great distance. A good idea of the effect of relatively large surface exposed by the finest solid particles, may be had when one recalls that the mass of a sphere of any substance is the product of three factors, namely, the surface area, the mass of the unit volume of the substance, and one-third of the radius of the sphere.

The weight of the particle is due to the force of gravity pulling the particles down, and opposition to this motion is developed by surface friction, which is some function of surface area.

The ratio of these opposing forces is, therefore, the weight of the particle divided by some function of its surface area; this is equal to the weight of a unit of the substance which is a constant multiplied by one-third of the radius of the sphere.

$$\frac{W}{f(S)} = U \times \tfrac{1}{3} R$$

W = weight of particle, S = surface area of particle, U = unit weight of substance, R = radius of spherical particle. With fume particles, R is small.

The flake-forming tendency seems to have been generally overlooked, in the ordinary problem of recovery of fume from furnace gases, and such a tendency might well be doubted, unless attention is called to the great disparity between the size of the smallest observed fume particle and the size of the molecules of which it is composed. This disparity stands for a great step forward in the aggregation of the solid particles.

It is when even lean zinc ores are treated purposely to volatilize and oxidize the zinc, that the result to this tendency is readily to be seen. I have often seen in the flues close to the furnace, floating flakes of zinc oxide as large as any snowflakes I have even seen. It will be profitable to study this analogy to see how far it will hold. The density of the snow flake is several times less than the density of the flake of metallic fume, just as the density of the ice molecule is less than that of the fume molecule. If we watch a snowfall, accompanied by a gale of wind, the depth of snow on the ground measures the amount deposited. The deepest drifts are formed by the action of strong winds. Here instead of a uniform deposit we see the accumulations in sheltered localities where the action of the air is relatively less. We can watch the effects of local eddies and of upward air currents, and draw from them useful lessons in the settling of solid particles.

Eddies Must Be Avoided in Flues

A few of the most obvious deductions are as follows: The tendency of the particles to fall being so slight, they should not be forced by eddies or upward gas currents to reverse the direction of this motion. The gases on their way from the furnace to the settling chamber may well be carried upward to improve the furnace draft. Thus, they will enter the chamber near its top, from this point their course should be horizontal or normally downward, and their exit should be near the bottom of the chamber. To provide a course of sufficient length, the flues should be zigzagged in a horizontal plane. Upturns should be avoided. Horizontal eddies which do not affect the draft, may be utilized to produce localities of comparatively still gas, where the fume will accumulate. The current through the chamber is produced by the pressure and exhaust fans and by the contraction of the gases in cooling. The actual velocity of translation will vary somewhat through different sections even if the flue has a uniform section throughout.

The kinetic energy in the gas issuing from the furnace is usefully employed in the uptake to increase the furnace draft, and also to carry the fume along to the place where it is desired to deposit it. That is, to a place where it will not obstruct the draft, and from which it can be economically removed. A manometer connected with this uptake would probably show less than atmospheric pressure.

But some idea of its maximum energy may be had. If this uptake were suddenly closed, and the furnace and connections were tight, and could stand the pressure, the pressure in the uptake would rise in consequence of arrested motion until it reached the point where the motion of the gas would be reversed, and it would be forced backward through the furnace and against the friction through the charge, and overcome the air pressure from the blowers.

Of this kinetic energy the blowers contribute that portion which corresponds to the velocity of influx in hydraulics. The heat generated, that is, so much of it as does mechanical work in expanding the gases, contributes another portion. Chemical forces which release gases, supply a third portion. With weights and composition constant, or assumed, in the unit of time the variables in this energy are temperature and velocity. The problem of the settling chamber is to dissipate this energy, to lower the temperature, and to reduce the velocity.

The velocity can be promptly reduced by a sudden enlargement of the flue. I shall assume for clearness that its area is increased three times at the entrance to the settling chamber. The velocity of the gases will not be uniform throughout this cross-section. Just as in the case where a rapid brook discharges into a lake, there will be established on the line of least resistance a current of more rapidly moving gas, instead of water, and out of this current the solid particles are to be allowed to fall, in order that they may settle in the stiller atmosphere, much as the finer particles of water-carried silt deposit in the quiet portions of the lake.

Cooling Methods Described

Thermal energy and mechanical energy being to some extent convertible, a separate treatment will not be attempted. Having considered the velocity factor, I will now touch upon the temperature factor. Four methods of cooling are practiced: (1) Dilution of the gases with cooler air; (2) absorption of heat, by evaporation of water, or use of water-cooling devices; (3) conduction of heat through the walls of the flues; (4) prompt removal of the settled fume, thereby abstracting the sensible heat it contains. The first two practices are only justifiable under peculiar circumstances, and they should be avoided if possible. The third method is the most effective, and I shall try to show how present practice can be much improved.

The conductivity of metals being much greater than that of any structural material composed from clay, metal plates should be substituted for brick walls when practicable. The rapidity of heat transmission being inversely proportional to the thickness of the walls, the plates should be as thin as is found practicable. The rate of transmission being directly proportional to the difference of temperature between the outer and inner sur-

face of the plate, efficient means should be taken to cool the outer surface.

With the object of keeping the walls of the flues cooler than the gases, and at the same time getting the effects of bracing, that is, strength and stiffness with the least amount of material and also economy in space occupied (which involves a saving in the cost of buildings, and in labor to handle the product), the following type of construction is recommended. The flue is turned backward through 180 deg., so as to reverse the direction in which the gas moves, after it has reached the length which can be conveniently spanned by a roof truss.

All Walls Should Be Exposed

The partition which serves to separate these consecutive divisions of the course should not consist of a single diaphragm, like a brick wall or a riveted metal plate. It should be built on the model of a hollow wall, through which outside air can freely circulate. This effect can be obtained by the use of upright iron studding, spaced at proper intervals and braced, and sheathed on both sides with a closely riveted sheathing of metal. This metal sheathing should be connected with the hoppers at the bottom of the several sections of the flue, and with the roof which is common to all of them. A hooded pipe extending through this roof and connected with the air space included in each partition wall, will increase the draft through the wall, and help to remove hot air and gases from around the hoppers, and the continuous roof will protect the iron sheathing of the partitions from the corrosive action of acid solutions which would be formed, if water, either meteoric or from condensed steam, were allowed to run down over them.

The iron studding could be of channel or I-beams, from four to six inches deep, either would give sufficient air space to have the effect of making all partition walls of the settling chamber outside walls of a long gas flue. This studding should start six inches or a foot below the top of the hoppers to afford an opening for entrance of air. Below this point, a number of brick walls serving as a support for the studding, would be built up from the foundation. These solid cross walls would isolate each hopper and shelter the discharged oxide from the force of winds, without requiring that each hopper should be entirely closed in.

The sheets used for forming the roof of the settling chamber and the bins, should be heavier than is required for the side sheathing. It is desirable that the side sheets which form the ends of the doubled back divisions of the flue, that is, the longer sides of the settling chamber, should be on the inside of the framing which supports it. To this framing, which may be of channel or I-shapes, diagonally braced on the outside, the sheathing should be secured by horizontal metal laths, securely riveted through the sheathing to the studs of the framing. These metal laths must be at proper intervals to resist any wind pressure they may be called upon to sustain. They need not be spaced with reference to the riveted joints of the sheathing. The roof rafters, such as required, should also be above the roof sheeting, which should be fastened to them in the same way as is the side sheathing to the walls. The framing of the hoppers should be independent of the framing of the walls of the settling chamber, it should be exterior to the sheathing of the hoppers. The binding laths should be in vertical planes, in order not to obstruct the free drop of the oxide to the bottom of the bins.

The sides of the hoppers should be inclined at an angle of 50 deg. with the horizontal. This will bring them together on the sides, in a flue 8 ft. wide, in a drop of 4 ft. 9 in., and will shorten their length longitudinally with the flue by 8 ft. at the bottom. From the inverted apex of this pinacoid the oxide should be continuously withdrawn by a chain conveyor, operating in a covered sheet-metal trough. There would be as many of these conveyors as there are bends in the flue. The return of the chain need not be closely housed.

Example of Flue Construction

To illustrate by a concrete example: An uptake pipe from the furnace to the settling chamber having a diameter of eight feet would have a cross-section of 50 sq.ft. This diameter limits the minimum width of the bends of the flue, including the thickness of one partition to 8½ ft. Allowing as suggested, three times this cross-section for the effective area of the flue, we have for its effective height, 150 sq.ft. divided by 8½(?) ft., equal to 18¾ ft. The center line of the doubled-back flue loses 4¼ ft. in length at each turn. If 40 ft. be assumed as a practicable roof span, each section has an effective approximate length of 36 ft. Ten of these courses side by side would give a length of 85 ft. and exclusive of the thickness of exterior walls, would be contained in a building 40x85 ft., about 30 ft. high. There would be 10 conveyors 32 ft. long inside of 10 hoppers, discharging either into separate storage pockets or into a pan conveyor, moving at right angles to them, which carries their discharge to a storage bin.

Two facts must not be lost sight of: All zinc ores are likely to contain lead, salts of lead are poisonous, dust must be guarded against. Second, the expense and loss from burned out bags is so great, that any reasonable expense involved in properly cooling the gases, is fully warranted by profitable returns. To which may be added that mechanical handling is generally cheaper than manual labor.

The velocity of 30 ft. per sec. in the uptake is reduced to an average of 10 ft. per sec. in the flues, neglecting on the one hand the lesser volume of the cooling gases, which would tend still further to reduce this average value, and on the other hand the air drawn in through the joints in the chamber walls, which by increasing the volume of gas to be handled by the exhaust fans, requires an increase in its average velocity, as in some measure balancing each other, we can picture for ourselves the flakes of oxide settling, by comparison with snow flakes drifting at the rate of $3600 \times 10 =$ 36,000 ft. per hour or in a gentle breeze of 6.82 miles per hour.

The uptake, with a velocity of 30 ft. per sec., discharges 90,000 cu.ft. per min. In addition to what I have called the available height of the flues, allowance of 6½ ft. to give working room below the hoppers, and the rise of the roof should be allowed, to be on the safe side. The sheathing should be made reasonably tight by close riveting and occasional painting. The exhaust fans should not work against an appreciable suction. A slight leak through the walls will serve to detach adherent flakes of oxide, and present clean surfaces of metal to the gases rubbing over them. With sufficient cross-section of flues in settling chamber, under the lee of the partition walls there will be a backward eddy, slack air, in which the deposit of fume drift is favored.

Requirements of a Settling Chamber

To sum up, the settling chamber should be designed with reference to the weight and volume of the gases issuing from the furnace so as not to retard the draft of the furnace. With reference to the bagroom it should be designed to cool the gases to a perfectly safe temperature. It should remove as much of the solids carried by the gas as is found practicable for any given furnace operation. It should not throw any unnecessary work on the fans to the bagrooms, and it should avoid dilution if possible. Cooling gases by dilution is sometimes necessary, but it is generally an expensive method of doing so.

The cellular structure I have indicated with hollow walls and exterior framing, presenting smooth interior surfaces, lee shelters favorable to settling, prompt withdrawals of hot fume, air circulation around the outside, appears to combine strength and protection from the weather, with economy of material and light sections. Sheets of $\frac{1}{16}$-in. metal so employed will outlast sheets two or three times as thick in situations where they have to sustain a transverse load made up of their own weight and an uncertain weight of possibly corroding fume. A vertical metallic screen in front of the

exhaust fans, acting as a baffle plate, will prevent too strong local suction which might derange the normal working of the last section in the settling-chamber flue. The same object can be better attained by having a number of exhaust fans, properly arranged, each forcing the gases to a separate system of bags.

Mechanical Bag Shaker Desirable

The arrangement of hoppers under the bags and the discharge of these hoppers by chain conveyors, is an easily realized ideal. Mechanical shaking of the bags has been often proposed. I do not know that it has ever been accomplished in an entirely satisfactory manner. The peculiar snapping shake, which a skillful bagman uses to detach the adherent fume is difficult to effect mechanically without putting more strain on the material of the bag than it is fitted to stand. Still the proposal is not visionary, and I think it is the duty of everyone who designs a bagroom or uses one, to seek every possible means of relieving his workmen of this necessary but unhealthful work. I can find no precedent from which to estimate the proportion of fume which can be advantageously settled out of gases heavily charged with fume, in such a settling chamber as I have described.

By gases heavily charged with fume I mean those issuing from furnaces which are especially designed to volatilize and burn the zinc with the least practicable consumption of fuel, and the least possible admission of excess air. The recovery of the fume unavoidably produced in all furnace operations has little bearing on this question. Nor is much to be learned from experience gained in the manufacture of sublimed metallic pigments. For in this latter case the object is to obtain a marketable paint having the required purity, color and texture, and by comparison with this object, other considerations are of minor importance.

Moderate Sized Units Favored

A necessarily experimental design should take as a starting point a rationally constructed settling chamber, of moderate dimensions, which will serve as a unit in a system of multiple units to be developed as the business expands. The furnaces and bags connected with this chamber should have rather less capacity than may ultimately be required of them. It is a simple matter to connect additional furnaces with the settling chamber, either through the original uptake, should that be of sufficient cross-section, or by a separate uptake if it is found that the settling chamber will successfully handle more gas and fume than it is receiving.

The same thing is true of additional filtering surface of bags, and also of additional pressure and exhaust fans which may be desirable, provided these probable extensions enter into the original plan.

Conditions of the markets, ore supply, changes in the character of available ores requiring different furnace treatment, the state of the weather, necessity for repairs, all favor a system of moderate-sized units. Throughout I have used the generic term fume, to connote those solid particles carried by gases issuing from a furnace which have been volatilized or sublimed. They will be mingled with other solid particles, which may be included under the general term furnace dust; this furnace dust may be made from the fuel, as soot, coke and ash, from the ores and fluxes or from the blast, they invariably are present with the fume, no attempt is made to separate them or to consider them separately.

Classification of Fumes

Fumes might be classified, according to composition, according to size, according to density, or according to state of aggregation; in the general treatment such classification is unnecessary. In most discussions of the behavior of furnace gases, the unit most convenient to employ is that of weight. The expressions, volume, density and velocity, are used in a generally understood conventional sense. That is to say, they are calculated averages under observed conditions, or they are those averages of volume, density and velocity, reduced to standard conditions of temperature and pressure. In case they are average values, they may imperfectly represent actual conditions. An average value may be a mean between widely different values, and so stand for a condition which does not exist.

A reduced value corresponding to standard conditions for any one of these qualities, volume, density and velocity, suggests something entirely different from actually existing conditions.

Direct measurements of velocity are difficult, for anemometers would have to be rated for local densities and temperature. We have seen that manometers fail to register the kinetic energy of moving gases, just as local standpipes do not show the hydraulic head of water flowing through pipes. I think in looking into a new problem it is sometimes worth while to step aside from familiar and well beaten paths, even when we know just where these paths will safely lead us, and explore to see whether equally desirable objective points may not be reached by a little original reconnaissance.

Analyses of Commercial Tin

In connection with the new standard contracts for tin the committee of the London Metal Exchange has declared the following brands of tin deliverable in fulfillment of contracts:

Straits, Australian, Banka, Billiton

English—In ingots of about 28 lb. each of the following brands, viz: Consolidated (Bolitho, Daubuz, Michell), Cornish, Penpoll, Redruth, Williams, Harvey & Co., T. S. Sutton & Sons.

German—In ingots of about 28 lb. each of the following brands, viz: Th. Goldschmidt, Essen; Robertson & Bense, Hamburg; F. D. Bieber & Sohne, Hamburg.

Chinese—Chong Hing & Co., Wing Hong & Co.

In the course of its investigation the committee had analyses made of some of the brands, the results of which are given in the accompanying table.

ANALYSES OF COMMERCIAL BRANDS OF TIN

	Tin	Antimony	Arsenic	Lead	Bismuth	Copper	Iron	Silver	Sulphur
Banka	99.950	0.007	nil	trace	nil	0.018	0.045	nil	trace
Billiton	99.960	0.006	nil	nil	nil	0.023	nil	nil	nil
Penang	99.939	trace	0.003	trace	nil	0.016	0.028	nil	0.004
Singapore	99.870	0.008	0.045	0.034	0.003	0.052	0.003	0.006	0.005
Mt. Bischoff	99.795	0.015	0.063	0.037	0.005	0.035	0.042	trace	0.008
Pyrmont	99.938	0.017	0.019	trace	nil	0.022	trace	nil	0.004
Irvine Bank	99.580	0.062	0.034	0.221	0.025	0.126	0.002	0.018	0.004
Williams, Harvey & Co. No. 1a.	99.860	0.015	0.040	0.004	0.005	0.047	0.003	nil	0.006
Williams, Harvey & Co. No. 2..	99.560	0.166	0.037	0.162	0.007	0.050	0.005	trace	0.013
Williams, Harvey & Co. No. 2..	99.350	0.245	0.065	0.223	0.015	0.042	0.016	trace	0.013
Williams, Harvey & Co. No. 3..	99.200	0.300	0.037	0.396	0.007	0.100	0.013	0.014	0.006
Williams, Harvey & Co. No. 4..	99.941	0.011	0.022	trace	0.001	0.020	trace	trace	0.005
Penpoll No. 1	99.720	0.118	0.054	0.041	0.007	0.052	0.004	0.009	0.007
Penpoll No. 2	98.710	0.569	0.042	0.546	0.055	0.103	0.007	0.015	0.004
Penpoll No. 3	99.300	0.325	0.056	0.212	0.050	0.088	0.002	0.021	0.009
Redruth*	99.160	0.176	0.053	0.177	0.017	0.445	0.014	0.006	0.008
Th. Goldschmidt No. 1	99.860	0.004	nil	0.102	nil	0.043	trace	nil	trace
Th. Goldschmidt No. 2	99.460	0.015	nil	0.425	nil	0.069	trace	nil	trace
Th. Goldschmidt No. 3	99.150	0.122	0.046	0.143	0.112	0.352	0.007	0.006	trace
Chinese No. 1	99.343	0.031	0.040	0.434	0.007	0.052	0.010	trace	0.011
Wing Hong & Co. No. 2	98.662	0.039	0.035	1.035	0.012	0.134	0.014	trace	0.011
Wing Hong & Co. No. 3	95.280	0.381	0.050	3.995	0.020	0.106	0.026	0.018	0.008

*Cobalt 0.012 per cent.

Analyses by P. Weiller of fusions of mixtures, in varying proportions, of lead oxide and silica (*Chem. Zeit.*, 1911, Vol. 35, pp. 1063-1065) resulted in the metasilicate (PbO,SiO_2) being found to be the only well defined compound formed, though a more acid compound ($PbO,-2SiO_2$) was probably also formed. The existence of the orthosilicate or of a more basic compound could not be established.

Data of the World's Principal Mines

By S. F. Shaw†

Compiled from Annual Reports

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends	Cost per Ton	Ore Reserves Tons
Abangarez	C. R.	1910	31,317	272,550	60,000	$16.01	.....
Abosso Gold	W. A.	1910*	77,623	£30,991	£60,000	9.02	284,028
Alaska-Mexican	Alas.	1910	222,698	380,793	342,000	1.75	1,093,028
Alaska-Treadwell	Alas.	1910*	744,226	981,295	850,000	1.59	5,899,364
Alaska-United	Alas.	1910	420,659	252,446	135,150	1.36	2,619,573
Allouez	U. S.	1910	.....	71,096	.....	1.80	.....
Amalgamated Zinc	Aus.	1910	160,957	£43,390	.....	3.07	.....
Amparo	Mex.	1910	68,217	281,527	240,418	6.03	.....
Anaconda	U. S.	1910	3,253,343	5,720,902	6,930,000	.....	.....
Anchor Tin	Tas.	1910*	102,283	— £1,866	.....	8.48	.....
Arizona Copper	U. S.	1910*	754,187	£254,471	£214,518	.....	.....
Ashanti Goldfields	W. A.	1910	90,860	£118,878	£149,580	10.03	.....
Assoc. Gold Mining	Aus.	1910	128,181	141,000	.....	.....	.....
Assoc. Gold Mines of W. A	Aus.	1911*	105,238	—£5,846	.....	.....	.....
Assoc. Northern Blocks	Aus.	1910*	32,120	£7,577	.....	6.55	.....
Aurora West	Aus.	1910	128,163	767,939	1,000,000	4.57	339,000
Baltic	U. S.	1910	781,419	.....	.....	1.67	.....
Batopilas	Mex.	1910	43,612	— 106,258	.....	.....	.....
Bibiana	W. A.	1910*	57,576	£886	.....	7.02	417,877
Blackwater	N. Z.	1910	39,192	£39,231	£37,498	6.70	69,000
Boleo	Mex.	1910	365,000	.....	.....	.....	.....
Boston & Montana	U. S.	1909	1,374,504	.....	.....	.....	.....
Brakpan	S. A.	1910	.....	.....	.....	.....	1,720,181
Brilliant Extended	Aus.	½-1909	31,500	£15,846	£12,500	8.13	70,000
British Broken Hill	Aus.	½-1910	58,018	£16,334	.....	.....	410,000
British Col. Cop. Co	B. C.	1910	441,672	256,562	.....	.....	.....
Broken Hill Bl. No. 10	Aus.	½-1910	53,558	£3,991	£15,000	.....	.....
Broken Hill Bl. No. 14	Aus.	½-1910	12,420	£5,278	.....	.....	220,000
Broken Hill North	Aus.	½-1910	108,943	£26,785	£28,000	3.27	.....
		½-1910	136,044	£61,000	£35,000	4.29	1,500,000
Broken Hill Prop	Aus.	½-1910	.....	£37,864	.....	.....	.....
Broken Hill South	Aus.	½-1910	132,757	£37,543	£20,000	4.13	.....
		½-1910	179,117	£67,800	£60,000	.....	3,000,000
Buffalo	Ont.	1909	33,708	402,013	320,000	9.67	74,000
Bunker Hill & Sullivan	U. S.	1910	425,160	.....	917,100	.....	.....
Burma Mines	Burma	1910	28,772	£9,034	.....	25.62	.....
Butte & Boston	U. S.	1910*	372,965	751,712	399,680	6.98	.....
Butte Coalition	U. S.	1909	591,737	.....	250,000	.....	.....
Butters Salvador	Sal.	1909	21,664	£68,129	£103,125	18.37	100,000
Calumet & Arizona	Ariz.	1910	315,128	.....	800,000	9.49	.....
Calumet & Hecla	U. S.	1910	2,795,514	.....	2,900,000	2.31	.....
Camp Bird	U. S.	1910	79,714	£389,577	£178,000	9.42	83,900
Cananea Con	Mex.	1910	795,313	459,202	.....	5.76	.....
Cape Copper	S. A.	1910*	69,246	£124,659	£69,000	.....	.....
Carn Brea & Tincroft	G. B.	½-1910	38,892	£13	.....	5.25	.....
		½-1910	38,797	—£1,927	.....	5.22	.....
Caucasus Copper	Sib.	1909	30,100	.....	.....	.....	.....
Centennial	U. S.	1910	106,095	— 20,742	.....	.....	.....
Centennial-Eureka	U. S.	1909	109,430	.....	600,000	.....	.....
Chaffers	Aus.	1910	46,584	23,000	.....	.....	.....
Champion	U. S.	1910	722,051	939,205	900,000	1.90	.....
Champion Reef	India	1910*	252,779	.....	£60,666	7.65	322,513
Cinderella Deep	S. A.	1910	181,100	£43,225	.....	5.59	421,884
City & Surburban	S. A.	1910	308,266	£89,291	£68,000	5.02	828,936
Con. Goldfields of N. Z.	N. Z.	1910	21,363	.....	£21,273	4.48	25,944
Coniagas	Ont.	1910*	34,514	753,889	240,000	7.51	127,167
Con. Main Reef	S. A.	1910*	235,391	£72,575	£69,327	4.90	414,150
Copiapo	Chile	1910*	12,752	— £16,595	.....	26.18	56,425
Copper Queen	U. S.	1910	589,900	.....	6,300,000	.....	.....
Corocoro United Copper	Bol.	1910*	57,947	£8,382	.....	.....	.....
Creston	Mex.	1910*	107,500	.....	.....	4.74	284,310
Crown Mines, Limited	S. A.	1910	1,510,070	£1,182,224	£1,128,127	4.41	6,282,719
Crown Reef	S. A.	1909	172,378	£118,822	.....	.....	.....
Crown Reserve	Ont.	1910	2,749	1,368,124	1,050,000	.....	.....
Daly-Judge	U. S.	1910	47,002	94,177	.....	7.35	.....
			9,106	.....	.....	.....	.....
Daly West	U. S.	1910	85,000	.....	162,000	.....	.....
De Lamar	U. S.	1910*	44,961	£4,142	£4,000	9.90	.....
Detroit Copper	U. S.	1910	492,593	.....	1,840,000	.....	.....
Dharwar Reefs	Ind.	1909	21,574	.....	.....	.....	.....
Dolcoath	G. B.	½-1910	42,279	£13,018	.....	6.61	.....
		½-1910	44,659	£21,066	£21,500	7.18	.....
Dolores	Mex.	1910	.....	.....	270,000	12.60	64,759
Dos Estrellas	Mex.	1909	348,580	1,893,270	.....	3.54	2,018,000
Ducktown Sulphur, Copper & Iron	U. S.	1910	.....	£38,376	£24,458	.....	.....
Durban-Roodepoort	S. A.	1910	240,530	£61,721	£33,000	6.14	867,551
East Gwanda	Rhod.	1909	91,400	— £34,884	.....	6.46	.....
East Rand Prop	S. A.	1909	1,830,280	£1,259,653	.....	3.82	.....
Elm Orlu	U. S.	1909	55,996	.....	.....	.....	.....
Eldorado Banket	Rhod.	1910*	80,566	£81,513	£75,000	.....	196,458
El Oro	Mex.	1910*	316,138	1,004,816	826,100	4.93	441,639
El Rayo	Mex.	1910	.....	.....	62,400	6.23	53,100
Esperanza	Mex.	1910	188,108	858,669	200,313	5.60	367,363
Federal	U. S.	1910	741,650	944,705	840,000	.....	.....
Ferreira	S. A.	1910	346,150	£291,756	£285,000	3.84	598,671
Ferreira Deep	S. A.	1910	364,487	£528,937	£500,500	4.61	1,779,328
Franklin	U. S.	1909	170,546	.....	.....	2.06	1,250,000
Franklin Furnace	U. S.	1910	375,677	.....	.....	.....	.....
Frontino & Bolivia	Bol.	1910	13,140	£10,137	.....	18.61	.....
Gaika Gold	Rhod.	1910*	34,474	£1,352	.....	7.60	23,500
Geldenhuis Deep	S. A.	1910	827,065	£251,305	.....	5.32	2,521,481
Giant	Rhod.	1910*	65,953	£35,290	£36,688	5.00	307,821
Glen Deep	S. A.	1909	260,845	£121,739	£120,000	4.67	803,113
Globe & Phoenix	Rhod.	1909	41,257	£236,569	£230,000	.....	178,221
Glynn's Lydenburg	S. A.	1910*	32,155	£35,009	£42,500	..7.91	82,870
Golden Ridge	Aus.	1910	28,999	167,500	135,000	.....	.....
Golden Horseshoe	Aus.	1910	257,333	£75,294	£75,000	5.86	803,151
Goldfield Con	U. S.	1910	266,867	7,343,691	7,118,921	11.14	.....
Granby	B. C.	1910	1,175,548	564,946	270,000	3.08	6,250,000

†Mining engineer, 136 Liberty St., New York.

DATA ON THE WORLD'S PRINCIPAL MINES—(*Continued*)

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends	Cost per Ton	Ore Reserves Tons
Great Boulder Proprietary	Aus.	1910	195,407	£266,610	£262,500	$8.18	760,177
Great Boulder Perseverance	Aus.	1910	91,852	— £20,913	.....	4.40	772,214
Great Cobar	Aus.	1909	204,377	£42,238	.....	.....	2,877,000
Great Fingal	Aus.	1910	125,871	£21,642	£25,000	6.39	.....
Great Fitzroy	Aus.	1910*	53,416	.....	.....	.....	654,833
Grenville	G. B.	½–1910	21,047	£4,308	.....	5.87	.....
Guanajuato Con	Mex.	1909	86,580	.....	.....	4.16	.....
Guanajuato Red. & Mines	Mex.	1910	228,344	376,837	.....	2.44	.....
Gwalia Con	Aus.	1910*	63,338	— £6,372	.....	6.63	48,690
Hainault	Aus.	1910	68,719	74,000	37,000	.....	.....
Hecla	U. S.	1910	129,480	.....	200,000	.....	.....
Hedley Gold Mining	B. C.	1910	46,828	263,986	168,000	5.45	.....
Hercules	U. S.	1910	25,765	.....	536,000	.....	.....
Homestake	U. S.	1909	1,237,381	787,160	982,800	2.87	.....
Horn Silver	U. S.	1910	10,657	10,342	.....	9.37	.....
Hutti Gold Mines	Ind.	1910*	38,706	£9,236	£3,480	6.44	40,000
Independence (Stratton's)	U. S.	1910*	93,191	£18,107	£25,000	.....	.....
Iron Blossom	U. S.	1910	35,933	299,242	280,000	.....	.....
Iron Silver Mining Co	U. S.	1910	58,863	138,308	200,000	4.43	.....
Ivanhoe	Aus.	1910	232,842	236,785	220,000	5.36	985,036
Jubilee	S. A.	1910	55,011	£2,428	.....	.....	.....
Jumbo Gold	Rhod.	1910*	36,658	£18,632	.....	8.52	39,249
Jumpers	S. A.	1910*	98,196	£62,435	£40,000	7.68	63,523
Jumpers Deep	S. A.	1909	92,960	£64,366	£10,000	.....	60,000
Jupiter	S. A.	1910	267,398	£46,879	.....	4.92	1,074,009
Kalgurli	Aus.	1910*	127,600	£134,604	£150,000	7.54	400,000
Kerr Lake	Ont.	1910	4,277	1,198,220	1,050,000	80.50	.....
Komata Reefs	N. Z.	1909	13,390	£2,371	.....	8.61	20,900
Knights Central	S. A.	1910	302,228	£79,011	£45,000	4.25	700,000
Knights Deep	S. A.	1910*	650,820	£300,886	.....	2.98	1,700,000
Kyshtim Corporation	Sib.	1910	89,509	£64,335	.....	.....	1,500,000
La Blanca	Mex.	1910*	39,304	.....	.....	12.00	.....
Lake Copper	U. S.	1909	10,124	.....	.....	.....	.....
Langlaagte Estate	S. A.	1910	629,614	£300,134	£260,850	4.22	1,267,769
La Rose	Ont.	1910	.....	.....	449,558	.....	86,758
Le Roi	B. C.	1909	26,534	— £9,701	.....	15.20	.....
Le Roi No. 2	B. C.	1910*	47,329	£37,702	£36,000	7.04	.....
Liberty Bell	U. S.	1910*	133,899	282,147	143,606	5.27	.....
Lucky Tiger	Mex.	1910	40,690	485,304	429,000	10.06	218,280
Main Reef West	S. A.	1910*	189,649	£137,950	£112,500	4.35	430,000
Mammoth	U. S.	1909	401,244	.....	.....	.....	.....
Mason & Barry	Spain	1910	360,406	£65,458	£55,551	.....	.....
May Consolidated	S. A.	1909	178,845	.....	£115,500	4.21	400,416
McKinley-Darragh	Ont.	1910	43,582	976,640	.....	10.36	104,450
Mercur Con	U. S.	1909*	282,269	34,005	.....	2.62	.....
Mexico Mines of El Oro	Mex.	1910	136,372	.....	£214,391	4.75	283,735
Meyer & Charlton	S. A.	1910	153,717	.....	£80,000	4.61	277,029
Midas Deep	S. A.	1909	20,776	.....	.....	.....	.....
Minerals Separation	Aus	1910	179,218	.....	.....	1.82	.....
Moctezuma	Mex.	1910	447,555	468,000	.....	.....	.....
Mohawk	U. S.	1910	802,537	188,083	200,000	1.60	.....
Montana-Tonopah	U. S.	1910	50,245	134,715	60,000	10.26	26,000
Montgomery-Shoshone	U. S.	1909	68,632	86,703	.....	4.32	.....
Morning	U. S.	1910	333,900	.....	.....	.....	.....
Mt. Bischoff	Tas.	½–1910	110,664	£35,311	£21,000	0.94	.....
Mt. Boppy	N. S. W.	1910	78,690	.....	£42,350	5.37	234,684
Mt. Elliott	Aus.	1910*	.....	£6,790	.....	.....	440,000
Mt. Lyell	Tas.	½–1910	198,617	£90,533	£75,000	.....	3,648,376
Mt. Morgan	Aus.	1910*	397,228	.....	£150,000	9.63	.....
Mungana	Aus.	1909	26,052	£1,096	.....	9.06	.....
Mysore	Ind.	1910	246,425	£384,910	£350,750	10.06	1,100,453
Nababeep	S. A.	1910*	54,050	.....	.....	.....	219,800
Napa Consolidated	U. S.	1909	18,583	61,899	.....	.....	.....
Namaqua Copper	S. A.	1910	30,539	£34,794	£23,583	.....	94,883
Natomas Consolidated	U. S.	1909	.....	870,410	.....	.....	.....
Nevada Consolidated	U. S.	1909	2,237,028	2,345,382	.....	2.76	40,360,823
New Goch	S. A.	1910	338,618	£140,626	£82,500	4.71	741,688
New Heriot	S. A.	1910	149,990	£107,504	£92,000	4.93	485,585
New Idria	U. S.	1909	67,247	109,639	120,000	.....	.....
New Kleinfontein	S. A.	1910	466,882	£288,577	£218,250	3.89	1,397,412
New Modderfontein	S. A.	1910	523,550	£169,972	£165,000	4.87	2,581,744
New Primrose	S. A.	1910	257,168	£210,278	£185,000	4.00	490,809
N. Y. & Honduras-Rosario	Hon.	1910*	36,634	349,476	105,000	13.00	107,575
Nigel	S. A.	1910	208,880	.....	£66,931	5.21	227,304
Nipissing	Ont.	1910	6,699	2,167,103	2,100,000	.....	.....
North Butte	U. S.	1910	408,528	.....	446,000	.....	958,680
North Star, California	U. S.	1910	90,100	677,074	575,000	6.17	.....
Nourse	S. A.	1910*	463,277	£191,504	£151,875	5.28	2,142,047
Nundydroog	Ind.	1910	91,000	£143,957	£117,916	10.19	141,296
Old Dominion	U. S.	1909	.....	455,282	486,000	.....	.....
Oregum	Ind.	1910	133,407	£148,406	£129,250	7.60	164,534
Oriental Con	Chosen	1910	320,707	623,676	.....	.....	838,250
Original Con	U. S.	1909	226,492	181,359	.....	7.29	.....
Oroyo-Black Range	Aus.	1910*	54,180	£24,516	£24,986	8.39	.....
Oroya-Links	Aus.	1910	100,177	125,000	71,000	.....	.....
Oroville Dredging	U. S.	1910	+566,612	275,452	.....	.....	.....
Osceola	U. S.	1910	1,217,720	.....	961,500	1.28	.....
Otavi	W. A.	1909*	44,250	£100,360	£140,000	27.55	.....
Ouro Preto	Braz.	1910*	75,612	£7,679	£6,163	6.60	169,991
Pahang Con	Malay	1910*	80,736	— £7,296	.....	5.88	.....
Panuco	Mex.	1909	13,411	238,419	212,500	4.15	.....
Parrot	U. S.	1909	122,349	.....	68,954	.....	.....
Penhalonga	Rhod.	1910	116,278	— £13,900	.....	5.28	150,175
Peñoles	Mex.	1909	176,616	298,570	499,200	5.58	.....
Pittsburg Silver Peak	U. S.	1909	150,359	337,004	.....	.....	.....
Poderosa	Chili	1910	23,341	£38,471	.....	.....	35,000
Portland	U. S.	1910	67,515	372,424	240,000	.....	.....
Princess Estate	S. A.	1910	120,414	£58,431	£53,000	5.53	.....
Progress	N. Z.	1910	50,202	— £13,220	£10,312	8.39	.....
Prestea Block A	W. A.	1910	.....	.....	.....	.....	678,859
Quincy	U. S.	1910	1,373,124	725,871	550,000	1.70	.....
Randfontein Central	S. A.	1910	.....	.....	.....	.....	2,822,713
Randfontein South	S. A.	1910	1,168,641	484,011	300,000	4.64	2,788,099
Rand Mines Limited	S. A.	1909	.....	.....	.....	4.46	4,000,000
Real Del Monte	Mex.	1909	215,209	.....	.....	.....	.....
Republica	Mex.	½–1910	3,870	.....	.....	19.08	.....
Rezende	Rhod.	1910	43,800	£16,624	.....	5.21	112,980
Rio Plata	Mex.	1909	14,580	20,046	140,037	8.18	.....
Rio Tinto	Spain	1909	1,788,987	£1,515,623	£1,206,250	.....	.....
Robinson	S. A.	1909	550,176	£940,696	£825,000	3.05	2,788,362

DATA ON THE WORLD'S PRINCIPAL MINES—(*Continued*)

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends,	Cost per Ton	Ore Reserves
Rooiberg Minerals Dev	S. A.	1910*	15,713	£12,681	.....	.....	24,300
Rose Deep	S. A.	1910	656,954	£289,813	£280,000	$4.75	3,553,474
Round Mountain	U. S.	1910	36,252	84,313	69,322	6.17	111,928
Salisbury Gold	S. A.	1909	95,057	£24,843	£25,000	3.69	162,289
San Rafael y Anexas	Mex.	½-1910	48,978	.....	.....	.....	.....
San Toy	Mex.	1910	20,181	157,556	.....	25.70	.....
Selukwe	Rhod.	1910*	25,764	£8,870	.....	5.84	27,000
Seoul Mining	Chosen	1910	32,793	215,151	100,000	4.66	190,100
Shannon	U. S.	1909	307,271	84,337	.....	7.58	.....
Sheba Gold Mining	S. A.	1910*	40,750	£1,871	.....	7.28	.....
Simmer & Jack	S. A.	1910*	827,530	£555,529	£525,000	3.10	2,690,000
Simmer & Jack East	S. A.	1910*	365,620	£63,989	.....	4.33	950,000
Simmer Deep	S. A.	1910	480,803	£60,712	.....	4.03	1,255,000
Skidoo	U. S.	1909	14,726	92,617	50,000	6.55	.....
Snowstorm	U. S.	1910	62,700	.....	120,000	.....	.....
Sons of Gwalia	Aus.	1910	162,082	£112,360	£97,500	.....	.....
South Crofty	G. B.	1910	60,916	£11,487	£7,500	5.31	.....
South Kalgurli	Aus.	1910*	110,199	£20,858	£20,000	5.48	171,877
Spassky Copper	Sib.	1910	10,794	£9,522	.....	.....	170,100
Standard Con	U. S.	1910	23,570	.....	.....	.....	3,275
St. John Del Rey	Braz.	½-1910	92,400	£45,846	£27,275	8.44	.....
Stewart	U. S.	1910	55,347	.....	.....	.....	.....
Sudan Goldfield	S. A.	1910	14,662	— £6,227	.....	10.31	6,010
Sulphide Corporation	Aus.	1910*	231,748	.....	.....	1.90	2,702,000
Superior	U. S.	1910	140,514	.....	.....	2.69	.....
Superior & Pittsburg	U. S.	1909	251,042	.....	.....	10.81	.....
Surprise	Rhod.	1909	29,643	— £6,853	.....	6.50	.....
Talisman Con	N. Z.	1909	44,800	.....	.....	.....	.....
Tamarack	U. S.	1910	525,554	— 191,345	.....	2.67	.....
Taquah Mining & Exp	W. A.	1910*	65,222	.....	.....	13.51	102,370
Tasmania Gold Mining	Tas.	1909	53,789	— £22,825	.....	.....	.....
Temiskaming	Ont.	1910	18,456	714,319	275,000	16.61	.....
Tennessee Copper	U. S.	1910	405,463	.....	300,000	2.80	4,563,671
Tharsis Sulphur	Spain	1910	362,750	.....	£156,250	.....	.....
Thistle-Etna	Rhod.	1910	37,261	£1,426	.....	5.55	.....
Tincroft	G. B.	½-1909	36,825	.....	.....	.....	.....
Tomboy	U. S.	1909	102,844	£59,861	£60,000	4.67	.....
Tombstone Con	U. S.	1909	15,070	.....	.....	.....	.....
Tonopah-Belmont	U. S.	1911*	81,056	1,522,302	450,000	.....	260,324
Tonopah Mining	U. S.	1911*	177,745	.....	1,550,000	10.07	354,940
Treasury Gold	S. A.	1909	109,235	£24,896	.....	5.29	201,580
Trenton	U. S.	1909	157,167	165,111	470,000	7.04	.....
Trethewey	Ont.	1910	19,103	237,800	.....	.....	.....
Tri-Mountain	U. S.	1910	317,299	32,250	150,000	.....	.....
Troitzk Goldfield	Sib.	1910	40,621	— £9,429	.....	6.27	40,400
Tronah	Malay	1910	410,777	£72,927	£56,000	.....	.....
Tyee Copper	B. C.	1910*	45,760	£1,200	.....	.....	.....
U. S. S. R. & Mining Co	U. S.	1910	777,355	2,484,318	2,404,653	.....	.....
Utah Apex	U. S.	1908	33,407	124,185	.....	.....	80,000
Utah Con	U. S.	1910	.....	65,349	150,000	.....	381,000
Utah Copper	U. S.	1910	4,340,245	5,401,775	4,648,675	.....	152,130,000
Van Roi	B. C.	1910*	32,313	£3,927	.....	.....	16,035
Van Ryn	S. A.	1909	358,230	£279,386	£225,000	3.76	1,419,430
Village Deep	S. A.	1910	508,540	£154,067	£106,067	4.45	1,704,226
Village Main Reef	S. A.	1910	492,446	£360,654	£330,400	4.91	1,775,175
Vivian Gold Mining	Aus.	1909	41,146	— £2,241	.....	5.60	35,219
Vogelstruis Con. Deep	S. A.	1910	41,258	.....	.....	7.25	149,530
Waihi	N. Z.	1910	442,020	£559,191	£396,725	4.04	.....
Waihi Grand Jc	N. Z.	1910	84,226	£30,646	.....	3.71	.....
Washoe	U. S.	1909	205,377	.....	.....	.....	.....
Wanderer	Rhod.	1910*	190,278	.....	.....	1.68	693,745
West Rand Prop	S. A.	1910	242,000	£46,555	.....	4.78	1,124,631
Wheal Kitty	G. B.	½-1910	7,191	£2,659	£664	6.04	.....
		½-1910	7,636	£1,173	£783	6.37	.....
Witwatersrand Deep	S. A.	1910	474,600	£267,413	£271,824	4.55	1,692,922
Witwatersrand Gold	S. A.	1910	426,910	.....	£148,750	3.83	1,232,784
Wolhuter	S. A.	1910*	304,360	£122,554	£86,000	4.26	753,679
Worchester Expl & Gold	S. A.	1910	55,330	£25,177	£16,751	3.87	.....
Yukon Gold	Yukon	1909	+3,087,127	691,682	700,000	.....	.....
Zinc Corporation	Aus.	1910	270,637	£97,906	£89,513	.....	.....

NOTE.—Abbrevations used in above table: Alas., Alaska; Aus., Australia; Bol., Bolivia; Braz., Brazil; B. C., British Columbia; G. B., British Isles (Cornwall); C. R., Costa Rica; Hon., Honduras; Ind., India; Malay, Malay States; Mex., Mexico; N. S. W., New South Wales; N. Z., New Zealand; Ont., Ontario; Rhod., Rhodesia,; Sib., Siberia; S. A. South Africa; Tas., Tasmania; U. S., United States,; W. A., West Africa.
*Fiscal year. — Loss for the year. +Cubic yards. All profits and dividends are in dollars except where otherwise noted.

The above tabulation of data obtained from abstracts of annual mining reports published in the principal mining magazines, was compiled for the purpose of securing relative data on the costs of production of the various metal-mining companies operating in different parts of the world.

I have compiled this table for several years for my own use, and in the future expect to publish it annually, and if the various mining companies will send me a copy of their reports a greater degree of accuracy will be insured. It will be seen that English companies form a large percentage of those enumerated, as there is a greater tendency for these companies to make public the items of production, cost, ore reserves, etc., than is the case with American companies.

These data cover for the most part the calendar and fiscal years ending in 1910. Since the reports of many mining companies for the year 1911 will not be published before June, 1912, it is not possible to cover the year 1911 at this date.

The column headed "tonnage produced" refers to the tons of ore actually shipped to the smeltery or treated locally and does not include waste which was sorted out of the ore hoisted. It is customary among the Rand mines to note the amount of waste so hoisted and sorted out, but this applies to but few American mines. Some English companies use the long ton of 2240 lb. but as no distinction is made between the long and short ton in many of the abstracts published there has been no attempt to distinguish between same in this table.

Where sufficient data were given to enable it to be done, the profits are figured as the amount remaining after all expenses of operation, administration, depreciation, development, taxes, etc., were paid. Such money as was put into the capital account, however, is not included.

In figuring the cost per ton, all items in the nature of expenses of operation, administration, depreciation, etc., are included exactly as in the case of computing the profits.

The reserves are, of course, those given in the official report as the number of tons of ore remaining blocked out at the end of the year under review. Probable ore is not so included, neither is that portion of the vein which, though blocked out, is too low grade to return a profit.

London Tin Market in 1911

Remarkable developments occurred in this market over the New Year holidays. It had closed on Dec. 30 with a decline to £173 15s. per ton upon the announcement of increasing supplies of Banka tin for 1911: and consumers were eager to take advantage of this relapse in view of the serious shrinkage of stocks as disclosed by the December statistics. Large sales were privately effected at advancing prices, and when the market reopened on Jan. 3, there was keen competition among the buyers for the little which was on offer. The result was a rebound in the price of no less than £5 10s. for three months' delivery, and £5 for prompt. A slight and transient reaction followed, but the demand was keen from all quarters. There were liberal offerings from the East from time to time, but these were readily absorbed. The speculative market was virtually dominated by the bull faction throughout the month: it was now and again allowed to drift into a temporary relapse but only to be gripped again with increased vigor, and the advance culminated on Jan. 30 when £204 was paid.

In February fluctuations continued wide and wild. Starting with a decline price went during the month from £194 10s. down to £171 and up to £200. This was again the signal for aggressive selling, resulting in a fall to £187 per ton.

In March the market opened with prices unchanged, but these soon weakened. Fluctuations continued frequent and wild, the lowest being touched on March 16 when three months' warrants were booked at £173 10s: after which the tendency was generally upward until the end of the month when cash warrants closed at £188 17s. 6d. and three months' at £187 2s. 6d. The most notable features of the month were the constant stream of orders for consumption, the persistent diminution of stocks, the strong control of these stocks by leading operators, the occasional abstention of leading operators and the capricious attitude of Eastern sellers whose policy ranged from free selling to complete reserve.

The closing for April was £103 10s. for prompt delivery, and £190 10s. for three months; with every indication of decreased supplies from the Straits and constant drain on the available stock.

In May the market continued as active and eventful as ever. The American demand has slackened for some time past, but a reduction of 2801 tons in the visible supply during April sufficed to demonstrate the underlying strength of the market, more especially as it was known that a substantial bear account was open for June and that supplies from the East were restricted. As the month advanced the "bull" control of the market became increasingly manifest. Some effort was made to initiate business on a new basis whereby sellers reserved option to deliver Straits or Australian tin at contract price, or Banka, Billiton, English of Chinese brands at certain allowances. Some transactions passed on this basis, but it lacked official recognition by the Committee of the London Metal Exchange, and no official quotation or settlement price could therefore issue, so that the project failed to influence the speculative market to any appreciable extent. Fluctuations in price were incessant and often sensational, prices were £195 10s. per ton for spot warrants, and £192 for three months': closing prices being £210 and £190 respectively.

June, as was expected, saw the climax of the strategy so long pursued by the controlling syndicate. Opening prices were £213 per ton for prompt warrants, and £190 10s. for three months'. The artificiality of the situation was not conducive to new speculative enterprise, nor were consumers disposed to buy more than they absolutely needed in such an inflated market. Trade requirements, however, could not be ignored, and their volume gave sufficient support to maintain the foregoing prices and occasionally to augment them. The crisis came about on June 9, when "bears" became alarmed at the tightening squeeze and paid up to £233 per ton for early delivery; this representing a backwardation of £43 per ton. The syndicate then reduced its prices almost sensationally by lending tin for three months' delivery at a backwardation of £10 only, as compared with about £42 which had ruled on the previous day. Simultaneously they lifted the price of forward tin from about £186 to £190, and thus brought cash values to about £200. On June 16 further quantities of prompt metal were provided at a premium of £5, and gradually the backwardation was wiped out entirely, prices for all dates coming to about the same level round about £188. Thereafter ensued an active business with consumers, particularly in America. Eastern sellers supplied the market so liberally that short selling was encouraged and values consequently relapsed.

In July the market opened with a fall of £1 per ton in the price of the prompt metal, but with not appreciable alteration in that of forward delivery.

In August the market was sensitive at the outset, particularly for early delivery although the volume of business was restricted. A little demand would serve to raise prices, which as quickly relapsed; the Syndicate being virtually in control though relatively quiescent. Speculative enterprise generally was checked by pervading industrial unrest, complications in international politics, and particularly by the persistent depression in the stock exchanges. The consuming industries were everywhere well employed, but there was some apprehension of unfavorable statistics at the end of the month.

September statistics showed a diminution in the visible supply. There was little speculative business in the market but trade demand—especially in America—continued active, so that the market was very sensitive although the turnover was relatively small. Leading operators abstained from any overt manipulation, but their evident control of the situation deterred others from taking risks.

In October the market opened actively with an aggressive bull campaign, partly stimulated by favorable statistics; but the dealings were for the most part professional and with little incentive for private speculators to take the heavy risks involved. The main tendency, however, was upward, top prices being reached on Oct. 23, when cash warrants were quoted £191 12s. 6d. and three months' £191 7s. 6d. These figures were generally regarded as artificially inflated, business being restricted in view of the control exercised by the Syndicate.

November opened with an apparently weak market, in spite of encouraging statistics. The new form of contract for standard tin had come into vogue and was operative for transactions maturing on and after Feb. 1: under which conditions a fair volume of business took place. The three months' price drifted down to £183 10s. on Nov. 3, and this proved to be lowwater mark. Meantime business was transacted in Straits and Australian sorts for delivery up to Jan. 31 at prices considerably above those ruling for February delivery in standard grade: and the Syndicate brokers accumulated large quantities of the former with the evident intention of holding same for a substantial premium. Tin now took a decided turn upward, and the advance in values continued with little interruption to the end of the month. The advance in prices was further stimulated by strong American demand toward the end of the month. The Dutch sales took place on Nov. 29, when 2500 tons of Banka fetched the remarkable equivalent of £208 10s. per ton. The result in London was eager buying of December supplies, mostly from the Syndicate, and ranging up to £205. Standard tin was also in better request.

In Decembed fluctuations in price were moderate during the early days of the month, with increased activity in standard tin under the new contract. Business in Straits and Australian for December and January dates was confined to consumers' orders and the covering of bear engagements: the prices rising at one time to £207 for prompt cash, and £201 15s. for late January. Thereafter speculative parcels were offered by holders at declining prices, and these were bought up mostly by the Syndicate: there being at the same time an active trade in Straits with eastern sellers.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Philip Argall has returned to Denver, Colorado.

R. J. Stone is at Deadwood, Calif., examining the Ferguson mine.

J. W. Mercer has returned to New York from a long journey in the West.

W. S. Keith is at Last Chance, Calif., inspecting the Home Ticket drift gravel mine.

Arthur D. Little, of Boston, has been elected president of the American Chemical Society.

C. O. Lindberg has moved his headquarters to 527 Union League Building, Los Angeles.

H. Kenyon Burch spent the holidays at Los Angeles, and is now returning to Globe, Arizona.

Henry F. Lefevre has returned to New York from Central America, and will remain here a month.

J. R. Finlay has gone to the Southwest on professional business, expecting to be absent about three weeks.

D. Tamblyn, recently in South Africa and now of London, is investigating mining properties in northern Ontario.

J. W. Vandergrift, late manager of the Swastika mine, Ontario, is now in charge of operations at the Lucky Cross.

Robert Linton has been elected general manager of the Sierra Consolidated Mines Co., at Ocampo, Chihuahua, Mexico.

E. L. Dufourcq, of New York, has just finished an examination of the Sovereign mine, in Ladies Cañon, Sierra County, California.

F. G. Lasier, Detroit, Mich., will be in Cripple Creek, Colo., and Salt Lake City in January, returning to Detroit about February.

R. H. Clark, formerly with the Joshua Hendy Co., of San Francisco, will move to Parral, Chihuahua, Mexico, to engage in mining and ranching.

W. H. Brule is now consulting engineer and manager of the Summit Hill Mining Co., at Dobbins, Calif., with head offices in San Francisco.

E. N. Breitung, of Marquette, Mich., has acquired control of the *Banker and Investor* magazine, published in New York, which is devoted to banking.

F. Justice Grugan has just returned to Philadelphia from an examination of properties near Rama, Nicaragua. He will go to Arizona early in February.

Morril B. Spaulding is consulting engineer in active charge of the Calaveritas Consolidated placer mines, near San Andreas, Calaveras County, California.

W. E. Davis, vice-president in charge of sales of the Goulds Manufacturing Co., Seneca Falls, N. Y., has just started on an extensive trip in the interests of the company.

George E. Collins has been elected president of the Colorado Scientific Society. Mr. Collins has gone to England on professional business, expecting to return to Denver in Februrary.

W. H. Charlton has resigned as chief clerk and purchasing agent of the Winona Copper Co., King Philip Copper Co., Ojibway Mining Co., and Houghton Copper Co., at Houghton, Mich., and will locate in Detroit.

J. M. Pennington, Jr., is superintendent of the Trojan Mining Co. cyanide plant, at Trojan, S. D., having been appointed Dec. 1. He is also superintendent of the Lundberg, Dorr & Wilson cyanide mill, at Terry.

B. G. Slaughter, Jr., has resigned as chief engineer of the Tennessee Copper Co., having completed the acid and bedding plant. He has accepted a similar position with the Pennsylvania Salt Manufacturing Co., at Philadelphia.

E. A. H. Tays will in January become manager for the Compañia Minera Occidental Mexicana and will be engaged in developing some good prospects in the Fuerte district in Sinaloa. His headquarters will be at San Blas, Sinaloa, Mexico.

George Kislingbury, of Los Angeles, is examining the Hanby mine in Calaveras County, Calif. The examination will include a mill-run of 1000 or 1200 tons of ore. Mr. Kislingbury was the first superintendent of the Bully Hill copper mine in Shasta County when it was purchased by Captain De La Mar, 12 years ago.

OBITUARY

William H. Tibbals died at Salt Lake City, Utah, Dec. 27. He was for a number of years connected with the Salt Lake Mining Exchange, and also served as correspondent of several Eastern journals.

Major Clarence Edward Dutton, U. S. A., died at Englewood, N. J., Jan. 4, aged 70 years. He was born in Connecticut, served in the volunteer army in the Civil War, and later as an officer of the regular army. For a number of years he was connected with the Geological Survey. He retired from service in 1901. Major Dutton was the author of "Geology of the High Plateaus of Utah," "Tertiary History of the Grand Cañon District," "Hawaiian Volcanoes," "Mount Taylor and the Zuni Plateau," and "The Charleston Earthquake of 1886."

The death of Ed. S. McKinlay, Jr., a bright young engineer, is deeply regretted by the mining fraternity of Denver, among whom he was widely known and universally esteemed and respected. He was 28 years of age, a graduate of Cornell University and by profession a mechanical engineer; but at the time of his death was secretary of the Yampa Valley Coal Co. and general superintendent of the company's mine at Oak Creek, Colo. He fell on the track in front of a loaded coal car and was crushed under the wheels, and though rushed to Denver on a special train he died on the way.

Societies and Technical Schools

American Institute of Mining Engineers—At the monthly meeting of the New York Section on Jan. 5, Dr. Gardner F. Williams, of Washington, delivered an illustrated lecture on the "South African Diamond Fields."

Canadian Mining Institute—The Porcupine branch of the Canadian Mining Institute was organized on Dec. 16. Many prominent mining men were present, including Dr. Frank Adams, president of the Institute, J. B. Tyrrell, Dr. Barlow and A. G. Burroughs, of the Ontario Bureau of Mines.

Los Angeles Mining Society—At a meeting held at Los Angeles, Dec. 28, over 100 engineers were present, and it was resolved to form an organization of the mining engineers of southern California for the purpose of professional intercourse and the maintenance of a reading room and a professional library. A committee, headed by Dr. F. J. H. Merrill, was appointed to arrange details.

University of Idaho—This institution offers short courses extending over a period of eight weeks, combining both laboratory and lecture instruction in mining, geology, chemistry and allied subjects. These courses are designed primarily for men who are unable to take regular courses at the university. They are for the purpose of giving that special knowledge that will improve a man's work and be of assistance to him in obtaining and satisfactorily filling the higher positions of shift boss, foreman, etc., in the mines and mills of the State. The second session begins on Jan. 8, 1912, and continuing for eight weeks, will terminate Mar. 2, 1912. There are no entrance requirements nor examinations, and while there are no age limits, the work is laid out for mature students who want to make the most of the time they spend at the university. In addition to railway fare, the total expenses will run between $50 and $70, which will be for living expenses entirely, as they are no charges for tuition nor laboratory fees. Supplementing the special work offered by the departments of mining and geology, lectures of general interest will be given during the short session on subjects of present importance, which will be treated in a nontechnical way.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 1—Active mining development and exploration in Weaverville Basin, the Trinity River region and the vicinity of Carville, during the last year, will extend the mining life of Trinity County, and should attract railroad construction and resultant industries. This county has been producing gold for more than half a century, and has never produced a pound of flour. Notwithstanding that the topography of the mining sections renders the Caminetti act regulating hydraulic mining ineffective, mining investors have until within a short time seemed to ignore the possibilities of the county. The lack of rail transportation has been probably the chief cause for this inattention; but instead of waiting for the railroad to develop the gold resources the gold must now develop the railroad.

The present active condition of the mining industry in the county is due initially to the progressive and profitable operation of the Headlight mine at Carville, begun in January of the present year. The application of modern methods of extraction and treatment to an old hydraulic mine has shown that there is profit in the mining of low-grade ore. During November the Headlight extracted and treated by milling and cyanidation an average of 212 tons per day of ore that averaged $5.14 per ton, recovering about 83% of the contents. About 75 men were employed. The cost of mining was 51c. per ton; milling and cyaniding, $1.03 per ton. An interesting feature of the low cost of mining is that, notwithstanding that the continuous method of milling and cyanidation is employed and that the plant is electrically driven, the transportation of ore is by mule and tram car. The hydraulic stripping of the overburden and the gloryhole method are the economic mining features. The latest activity in the district is at the southern end, in the Weaverville Basin, where two old hydraulic mines have been taken over by a recently organized company to be operated on more extensive lines. One of these properties, the Hupp mine, has been in continuous operation by the Hupp family for 50 years; by the simple method of hydraulic mining a profit has been made every year. The reason is clear; the gravel averages 25c. per cu.yd. This mine is situated at Weaverville.

The other important purchase of this company is the Union Hill, situated six miles south. This mine has equipment that cost $300,000, and includes 12 miles of ditch and a steel bridge over which the water is carried by inverted siphon across Trinity River. The ditch, which has its supply from Grass Valley Creek, carries 3000 miners' inches of water, The present company has acquired an additional 500 in. The Union Hill cleaned up last year $37,000; the cost of operation was $15,000. The gravel averages 8c. per cu.yd.

At the annual meeting of the Ophir Silver Mining Co., held at San Francisco, Dec. 20, Franklin Leonard, Jr., was reelected president, and B. F. Shaw vice-president. W. J. O'Connor and George S. Sturgis were succeeded on the board of directors by H. L. Slosson, Jr., and G. E. Arrowsmith. What is termed the progressive element endeavored to control the Ophir as it recently did the Mexican, but failed to do more than obtain two directors. The same fight between the present control of the Mexican and the present control of the Ophir will probably occur in the annual meeting of the Savage.

Denver

Jan. 4—Ever since the earliest days at Cripple Creek, ore stealing, which out of consideration for the sensitive feelings of the thieves, has been delicately described as "high grading," has been carried on without let or hindrance. "Change rooms" and other devices for stopping it were tried, these being easily met by making a "cache" of the ore in the waste dump on the night shift, and removing it at a convenient opportunity, or as in one instance, by the foreman causing himself to be fastened down in the shaft, while the "daring robbers" carried off sacks of sylvanite and calaverite from the ore house. Now, however, the Portland, Golden Cycle and Strattons' Independence have struck at the root of the evil by destroying the ready local market, which has all along existed for the loot. On their petition Federal Judge Robert E. Lewis has issued an injunction restraining 48 Cripple Creek assayers whom it was alleged were conspirators as receivers of the stolen products, from buying ore from the miners of the district. The petitioners alleged that they were losing about $8000 per month and that about $750,000 have been stolen within a year. It is hoped that this injunction will end the practice of "high-grading."

The El Paso mine which has produced gold ore to the extent of $7,000,000, is now in good shape to duplicate its past output. According to careful estimates, the developed ore at present approximates 76,920 tons of an average grade of $25.75 per ton and a total net profit of $1,189,029. The ore ground not technically "in sight" and now being developed down to the Roosevelt tunnel, or 1350 level, includes 263,384 tons of an average grade of $30 per ton and a net worth of $2,633,240. The C. K. & N. vein has been opened on the tunnel level in the Fuller crosscut at a point 1400 ft. below the surface and the breast shows $35 ore. This mine has produced some of the most remarkable ore in the Cripple Creek district, for between the 600 and 800 level, 3000 lb. were taken out that yielded $76,000, or over $35 per lb. There are 150 men employed on company account, and 100 leasers.

Butte

Jan. 4—If the new process for treating complex zinc-sulphide ores, invented in Germany and used with success in that country for some time, should prove to be as successful in the treatment of the Butte ore, it is not unlikely that a plant will be erected soon at Butte by Ex-Senator W. A. Clark for the treatment of zinc ore from the Elm Orlu mine, which has been closed down for some time for the lack of treatment facilities.

As agent for the International Metal Co. and for W. A. Clark, Adolph Wetzstein investigated the German process last year, and later Mr. Clark made a personal inspection of the plant and methods of operation while in Europe; he was so impressed with what he saw and learned, that 100 tons of Elm Orlu ore have been sent to Germany for a final test, and a representative of Mr. Clark will be present during the treatment of the ore.

As a result of the improvement in the price of copper metal, it has been decided by the directors of the Anaconda Copper Mining Co. to increase the output of its Butte mines somewhat. During the last year the mines have been operating far below their normal capacity, the average monthly production having been about 22,250,000 lb.; several of the mines are gradually increasing the output and within two or three weeks it is expected to have the average monthly output increased to 26,000,000 lb. of copper.

For the last two years operations of the East Butte company have been con-

fined to the Pittsmont property, comprising 267 acres of mineral rights, with a lease of the mineral rights on the Northern Pacific R.R. right-of-way crossing the property, and about 160 acres of surface rights. In making a cash payment of $688,758, Dec. 1, 1911, and giving notes for $1,625,574, the remainder due on the Pittsmont debt, the company hoped to be able to meet the notes from net earnings during the coming year rather than by issuing additional stocks or bonds; with the present improvement in the copper-metal prices, and the possibility of still further improvement, the management anticipates no trouble in thus liquidating the debt.

Salt Lake City

Jan. 4—The consolidation of a number of Alta properties, pending for some time, has been effected. The Michigan-Utah Consolidated Mining Co. was organized in this city Dec. 20, to take over the Utah Mines Coalition, City Rocks, Grizzly and Copper Prince properties, covering approximately 1200 acres of mineral ground, extending from Alta in Little Cottonwood north over the divide into Big Cottonwood Cañon. The company is capitalized for $2,500,000, divided into a million shares of stock, par $2.50. The distribution of stock to the companies forming the merger has not been officially stated, though it is said that half of the capital stock, or 500,000 shares, will be retained in the treasury. Of this, 250,000 shares are to be reserved for the conversion of a bond issue of approximately $625,000. Of the 500,000 shares to be distributed for the properties acquired, 250,000 shares will go to the Utah Mines Coalition, and the remaining 250,000 shares to the owners of the City Rocks, Grizzly and Copper Prince.

The consolidation may be the basis for taking in other operations adjoining, which can be developed advantageously through this company's ground. Operations at present can be carried on most advantageously from the Utah Mines Coalition, on the Big Cottonwood side, as this ground is most easily accessible. The Coalition company's drain and working tunnel will be extended to develop the City Rocks vein, which is said to have ore exposed at various points for 2800 ft. on the strike. A crosscut will be driven north from the same tunnel to connect with the Grizzly vein, of which the new Michigan-Utah company owns nearly 4000 ft. Connections between the tunnel and the old City Rocks workings have already been made, and it is expected to start a force of men on this ground soon. Salt Lake and Houghton, Mich., men are interested. The officers and directors are: Duncan MacVichie, president; J. P. Edwards, N. W. Haire, J. A. Pollock, R. H. Strickland, E. G. Woolley, Jr., and L. H. Farnsworth.

Negaunee, Mich.

Jan. 5—The season's iron-ore shipments from the Iron River district totaled 1,113,586 tons, and were the products from 15 mines. The four largest shippers in order, were the Dober mine of the Oliver Iron Mining Co., with 198,580 tons; Caspian mine of the Pickands, Mather & Co., with 165,660 tons; the Hiawatha mine of the Monroe Iron Mining Co., with 116,736 tons; and the Zimmerman mine of the Spring Valley Mining Co. with 111,095 tons.

It is interesting to note that the fifth in order of tonnage shipped was the Chicagon mine, with 108,947 tons, now operated by the Monroe Iron Mining Co.; this property when in the exploratory stage was abandoned by the Oliver Iron Mining Co., several years ago. The Davidson mine of the New York State Steel Co. made its initial shipment with 45,434 tons. The Wickwire mine on which the shaft was started last summer shipped 1919 tons and the Wickwire Steel Co. of Buffalo will have an opportunity to test the ore in its furnaces. The Hemlock mine of the Pickands, Mather company, situated in the Amasa district, shipped 105,320 tons. This mine has shipped ore since 1890, excepting 1894; for the last 16 years it has never shipped less than 69,000 tons per year.

In Ishpeming, the tax roll is $279,393, of which the three operating mining companies will pay 85%, or $237,140, leaving the balance, $42,253, to be borne by all other tax-paying interests. The Cleveland-Cliffs Iron Co., alone, will pay taxes amounting to $124,540; the Oliver Iron Mining Co., $100,995; Pittsburg & Lake Angeline Iron Co., which is a Jones & Laughlin company, will pay $11,604.

Joplin, Mo.

Jan. 3—The situation in the district at present is not particularly satisfactory. Prices are not as low as they have often been but there is a lack of harmony between the producers and the buyers and a wide range of prices evident at all times. There is no stability to the market and at times it is difficult to secure any bids on ore. Some producers are selling on the contract made by the American Zinc, Lead & Smelting Co. and, of course, are now highly elated over it. The unwillingness of a certain class of producers to acknowledge the justice of the claim for a larger smelting margin and the inability of the smelters to see or appreciate the total cost and risk of mining have up to the present prevented any harmonious action between the two. There is nothing to be gained by either in continuing to fight. Any advantage will be lost in the future under altered conditions. The selling of ores under a contract based upon the price of spelter with a fair smelting charge will serve to protect both producer and smelter to the best advantage.

Toronto

Jan. 5—The request for the restoration of the iron and steel bounties was renewed by an influential deputation which waited on the Government at Ottawa on Jan. 4. The delegation included Thomas J. Drummond and George E. Drummond of the Lake Superior Corporation; J. H. Plummer, president of the Dominion Steel Corporation; Robert Hobson of the Steel Co. of Canada, and Hector McInnes, of Halifax, representing Nova Scotia steel interests. A protracted conference was held, in the course of which the applicants presented voluminous statistics showing the effects of the bounties in stimulating the industry. The Government gave no assurances as to any action. It is understood in political circles that no tariff changes need be looked for during the coming session, and that it is altogether probable that the whole subject will be relegated to the Tariff Commission, whose early appointment has been promised.

Porcupine

Jan. 5—Fire has again visited Porcupine, partially destroying the town of Golden City. A large number of business places and residences were burned and at one time it was thought that the greater part of the town would be swept away. The loss will be heavy as the high insurance rate of 10% prevented the majority of business men from taking out insurance. It is doubtful if the burned section will be completely rebuilt, for since the completion of the railroad to South Porcupine, the necessity for the town of Golden City has been largely eliminated, as the majority of the larger mines are nearer the former town.

Good progress is being made with the Hollinger spur of the Temiskaming & Northern Ontario Ry. The government commission took over the construction of this work, several months ago, and although it has progressed much more slowly than anticipated it is now being pushed rapidly. The steel has been laid into Aura Lake settlement, where a station is being constructed. All the rock work is finished, and as soon as more piling has been driven for the bridge, over the end of Pearl Lake at the McIntyre property, the line will be completed as far as Timmins, the present terminus. By Feb. 1, the commission expects to have trains running.

The extension of the Temiskaming & Northern Ontario Ry., to Elk Lake, will start at a point between New Liskeard and Englehart, and it is stated that 80% of the country it will pass through is suitable for agriculture. It is evidently with this in view that the railroad will be built, because while Gowganda still holds out some promise of becoming a mining center, there is practically no hope at this time of Elk Lake ever becoming of any importance.

The Mining News

The Current History of Mining

Alaska

The steamship "Alameda" arrived in Seattle, Dec. 23, bringing gold bullion worth over $500,000, and a shipment of 800 tons of copper ore from the Bonanza mine, at the terminus of the Copper River & Northwestern Railway.

Engineer—The interests of several of the stockholders in this mine, at Atlin, have been sold to Capt. James Alexander. New machinery will be installed in the spring.

Lincoln—This placer property, in the Atlic district, has been taken over by W. H. Vance, who will improve it.

Alaska-Treadwell—During November the mills crushed 63,308 tons of ore, yielding $154,578 gross and net $49,858. Operating expenses were $89,834; construction, $14,885. The ore averaged $2.46 per ton and 765 ft. of development work were done.

Arizona

Cochise County

Calumet & Arizona—The new smeltery to be erected at Douglas, will have all possible labor-saving devices. A bedding system for mixing ores will be installed, similar to that at the Greene-Cananea, with a capacity for 34,000 tons. The main building will be 168x508 ft., and will contain two blast and four reverberatory furnaces and six converters. The power plant will also be enlarged and production will not be decreased while construction is in progress.

Gila County

Miami—This company, under the management of B. B. Gottsberger, continues to maintain its daily tonnage of 2500 tons. The sixth and last unit is virtually ready to be placed in operation with the exception of the Hardinge mills, which will be shipped early in January, and it is expected that this unit will be running by Feb. 1. The Hardinge mills in the fourth unit are reported to be giving excellent satisfaction. Churn drilling has been resumed on the Pinal claim, near No. 3 shaft, 1500 ft. northeast of the present developed orebody.

Inspiration—It has been officially announced that construction will begin immediately on the company's dam across Pinal Creek, 16 miles from the mine. The dam is designed to store the floodwaters incident to the rainy season and will be an important if not the chief source of water supply for the proposed new concentrator. Preparations are being made to sink wells on the Inspiration ranch to develop additional water. Construction of the temporary warehouse near the mouth of the main tunnel will begin at once and excavation for the permanent steel warehouse is practically completed. J. M. Callow, consulting metallurgist, states that the experimental mill is running smoothly and that tests have thus far been satisfactory. E. J. Harrison, representing C. H. Repath, the consulting construction engineer who will design the new mill, is assisting in the supervision of the tests.

Live Oak—Churn-drilling operations continue and drifting and raising are in progress at the eastern end of the orebody, tributary to No. 1 shaft. The station at the 900-ft. level in No. 2 shaft is not yet completed.

Copper & Silver Zone—This group of claims, two miles east of Globe, continues to produce high-grade silver ore, under the operations of several groups of lessees. A drift is being run eastward from the old Clark shaft at a depth of 83 ft., and has opened 3 ft. of ore, estimated to run over 50 oz. of silver per ton. On the east end of the Old Ironsides claim, a vein 8 to 10 in. wide has been stripped for a length of 18 ft. and to a depth of 4 ft. This vein is estimated to average 15% lead and over 80 oz. of silver per ton. A shipment of six tons recently made from this group assayed 108 oz. of silver per ton.

Summit—The Gibson Copper Co. has formally taken possession of this mine, formerly known as the Gibson. This mine was taken over by the Summit Copper Co., in June, 1910, under option from the Gibson Copper Co. The Summit company worked the mine for over a year and gave up its option in December, 1911. As yet no reason for this action has been given to the stockholders, but it is generally believed that the company is without funds.

Manitou—The company is employing seven men on the Five Points group of claims, 15 miles west of Globe. The 125-ft. Cracker Jim shaft is being unwatered preparatory to sinking to the 200-ft. level, and crosscutting to the Maverick vein at that depth.

Superior & Boston—Crosscutting north to the Great Eastern and Old Dominion veins on the 12th level is steadily progressing. A sump is being cut and a 1000-gal. Prescott pump is being set up on this level. It is believed that this pump will be able to handle any flow of water that may be encountered when the veins shall have been cut. A. C. Stoddard is superintendent.

Southwestern Miami—The company continues to develop its ground by churn-drilling. The drill is working on hole No. 2, which is now 130 ft. deep. Ore is expected at a depth of about 900 feet.

Orphan—The company is doing assessment work on its 10 claims lying southeast of the New Keystone on the edge of the schist belt near a contact of the granite porphyry and the schist. The ground is developed principally by a 560-ft. shaft from which over 600 ft. of crosscutting has been done on the 500-ft. level, by which five veins of variable width and copper content are reported to have been disclosed. The management believes that the future of the property depends upon demonstrating the existence of large bodies of disseminated ore, and future development will be conducted along that line.

Barney—This company has completed assessment work on its group of 26 claims lying west of and adjoining the Live Oak property.

California

Amador County

Bunker Hill—A cleanup of $30,000 for November is reported.

South Jackson—A new electric hoist is to be installed. Extensive development is planned.

Wildman-Mahoney—These mines have been taken over by the Chichizola estate. Active operation ceased about five years ago for lack of funds. Large ore reserves are said to be opened and resumption of work, it is believed, will make the property again productive.

Poundstone—A contract is reported to have been let for the construction of a 20-stamp mill for this mine, at Sutter Creek.

Butte County

Lakeview No. 2—This well, which had been sanded up for some time, has started flowing at the rate of 500 bbl. per day.

Santa Fé—The combined flow from wells Nos. 6 and 7 is 7000 to 8000 bbl. per day. The old 2-6 well is equipped with electric power again on the pump, making 400 bbl. per day.

Calaveras County

Leonard D. Baldwin, of New York, has purchased for Eastern interests the mining and water rights owned by Rigney & Norman, of San Andreas. The deal includes the Table Mountain mine, at Martin's flat, and the Cave City placer mines and Calaveritas properties.

Inyo County

Skidoo—Total production of this mine for October was $21,623.43; expenses, $9,123.56. The mill treated 1266 tons of company ore and 229 tons for leasers. During November the company milled 1192 tons of company ore and 144 tons of leasers' ore, a total of 1336 tons. Total receipts were $15,909; expenses, $8537; net profit, $7371. Development cost $938 and $7599 were spent for operating.

Kern County

Good Hope—A 15-hp. hoist will be installed with a 24-ft. headframe and skip. The shaft is down 150 feet.

Los Angeles County

Standard—The new refinery at El Segundo had its initial run on Nov. 27 with five stills in operation. The oil so far handled is from the Central wells at Whittier and the Fullerton wells in Brea Cañon. The pipeline from Northam to El Segunda, 21 miles long, is completed. The refinery will have a capacity of 15,000 bbl. per day when the plant is completed.

Modoc County

Sunshine—Schauer & Laughlin have moved their stamp mill to New Pine Creek, where better power facilities are obtainable. The mine will be worked all winter.

Napa County

Oathill—This quicksilver mine is reported to have been leased for five years, with a view of working the dumps. The Napa Consolidated Quicksilver Co., San Francisco, is the owner.

Nevada County

North Star—The company paid out as Christmas presents more than $4000, giving to each miner $10 in gold, and to each carman and shoveler, $5. This has been a custom for many years.

Canada Hill—Preparations are being made to sink a new shaft 500 ft., to intersect the Canada and the St. Louis veins. R. W. Gaylord, of Nevada City, is owner.

Pennsylvania—This mine and the W. Y. O. D. have been acquired under a long-term lease by the Empire and will be developed on a large scale with new machinery.

San Mateo County

Reed Zinc Co.—This company is planning the erection of a plant, near Dumbarton Point, to reduce zinc sulphide ores. The process to be used is patented by C. J. Reed and Carl Hering, and is a combination roasting-lixiviation and electrolytic-precipitation method. The company's offices are at 520 Head Building, San Francisco; Frank A. Leach, formerly superintendent of the U. S. Mint at San Francisco, is president, and C. J. Reed, formerly of Philadelphia, is general manager.

Sierra County

Gold King—A 12-ft. vein, showing free gold, has been cut in the tunnel which is being extended at this mine, near Alleghany. Cliff Weldon is manager.

Neocene—The extremely dry fall weather, resulting in a shortage of water, has forced the temporary closing of this hydraulic mine, at Scales. The hydraulic mine at Brandy City is operating with a reduced force.

Emerald—An arrastra is to be built on this group of claims, in Jim Crow Cañon. The quartz opened while doing assessment work this season shows much free gold. Smith & Shippsy are the owners.

Dodson—Good gravel is now being taken from this ranch on Little North Fork by James F. Hunt, an attorney, who has an option on the property.

Colorado

Boulder County

Discoveries of vanadium are reported in the Magnolia and Eldora districts. Samples assayed by a number of chemists are said to have shown from 1.26 to 7.33% vanadic acid.

Clear Creek and Gilpin Counties

Rockford—Sherman Harris, leasing this mine in the Russell district, is reported to have opened a vein from which ore is being shipped that carries 3½ oz. gold, 22 oz. silver and 15 per cent. copper per ton.

Baker—In this mine on McClellan Mountain, an 8-in. streak of ore has been discovered which assays $180 per ton in gold, silver, lead and copper.

Fremont County

United States Zinc Products Co.—This company has secured a 10-years' lease on the old smeltery of the United States Reduction & Refining Co. at Canon City and has put 70 men to work. It is stated that the old dump of the plant is to be worked over under a process for the chemical separation of ores devised by Sewell Truax, of Chicago. The manufacture of zinc oxide is a specialty of this company and will be carried on continuously under Superintendent Bocking.

Lake County—Leadville

Helena—It is reported that ore is being sacked at the mine in Iowa Gulch that yields about 17 oz. of gold and $20 in silver and lead per ton. This ore comes from the sixth level and is about 10 in. wide.

Silver Spoon—In the north drift at the 600-ft. level of this mine on Prospect Mountain, it is stated that a vein 4 ft. wide has been opened, that carries ore running as high as 5 oz. gold, 75 oz. silver and 10% copper per ton, and that nearby is another one about 2 ft. wide carrying ore that runs 1½ oz. gold and 25 oz. silver per ton.

Birdelia—The tunnel is now in about 1400 ft. and small streaks of fine ore are being found on the Amity vein. In about 150 ft. more the Fairplay vein will probably be cut.

Ouray County

Camp Bird—The estimated net profit for November is £47,890, and a balance of £47,590 is applicable to profit.

San Miguel County

Tomboy—During December the mill treated 9700 tons of ore, yielding $79,500 gross and net $35,000. Expenses were $44,500 and $740 were expended on permanent improvement.

Teller County—Cripple Creek

Ajax—The Colburn mill, using the Clancy process, was started Dec. 1 and is stated to be treating about 100 tons per day.

Forest Queen—An oreshoot opened recently gives returns as high as 15 oz. gold per ton for screenings. The property is being operated under lease by John Connors.

Granite—It is stated that the 1000-ft. level will be drained soon, after which it will be available for ore shipments. This company is unique in the history of Cripple Creek, inasmuch as its officers do not draw salaries.

El Paso—During the last six months of 1911 there was produced on company account, 10,269 tons of ore averaging about $20 per ton; by leasers, 7326 tons, averaging $17 per ton in gold. The development in the lowest levels made possible by the deep drainage tunnel has placed this mine in better condition than ever and has given additional evidence of the permanence of the ore grade in the district with depth, as the best ore is coming from a horizon 500 ft. deeper than any ore has been found in other veins. Allen Burris is manager.

Strattons' Independence—During November, the production was 2767 tons, averaging $19.47 per ton. Low-grade mine and dump ore amounting to 10,000 tons was milled. Net working profit at mine and mill was $14,605 and $1200 were spent on special development. On Dec. 19, cable dispatches to the home office stated that the mine was looking well and that the new discovery in the Hoodoo stope was 16 ft. wide and showed $30 ore.

Idaho

Couer D'Alene District

Evolution—The new concentrator which was recently constructed is now operating steadily and is giving entire satisfaction. The first shipment from the mine will be made soon, as the concentrates are being hauled to Osburn station.

Liberty—Samples of ore carrying 13% copper, 6 oz. of silver and a trace of gold have been brought to Wallace from this property. About 600 ft. of development work have been done and for the shallow depth at which the work has been done the showing is remarkable. The property is situated on the Montana side of the divide.

Tarbox—This mine, situated near Saltese, and which was swept by forest fires a year ago, is preparing to renew activities. The ore already developed is considerable and an entirely new plant will be erected.

Michigan

Copper

Wyandot—The crosscut is reported to have reached the footwall of the lode after passing through 80 ft. of vein matter.

Wolverine—It is reported that a good showing of copper has been disclosed at the 300-ft. level of No. 5 shaft on the Osceola lode.

Mayflower—The drill is reported to have disclosed an unusually rich core recently. The new find was made at a depth of 1328 ft. and continued for about 70 ft. at an angle with the dip of the lode. It is said that the mineralization is well disseminated throughout all but 10 ft. of the core and that heavy copper shows at intervals for about 50% of the distance. The core has been compared favorably as to richness with that extracted from the Indiana property, almost exactly two years ago. This discovery is an important one and has considerable bearing on adjacent properties.

New Arcadian—Drilling has been resumed in section 31, where a depth of 700 ft. has been reached.

Franklin—It is said that the property is in readiness to produce at the rate of about 1200 tons per day. Underground forces are being increased and steam is expected to be turned into the new hoist in a few days.

Indiana—The shaft is down about 533 ft. and is said to be in felsite. A fair showing of copper was reported at about 512 ft., but is not in evidence at the present depth.

Algomah—According to a recent statement by President Dow, a crosscut is being driven west from the bottom of the shaft at a depth of 212 ft. to intercept the two lodes disclosed by Nos. 1 and 2 drill holes. As shown in those holes, both lodes were from 30 to 40 ft. wide, showing nuggets and considerable fine copper. No. 6 drill hole recently encountered an amygdaloid at a depth of 1867 ft., continuing in it for about 100 ft. and showing fine copper.

Ahmeek—Development work in 1911 made available five levels of new ground at Nos. 3 and 4 shafts. Operations at these shafts have been confined to development. Three of the four stamps in the mill are working full time and the fourth half time.

Iron

Extensive repairs are being made to the ore docks of the Chicago & Northwestern Ry. Co. at Escanaba; it is calculated that $80,000 will be spent this winter in rebuilding portions of the docks. Old No. 1 dock will be torn down and later a steel pier will be built in its place. Minor improvements are planned for the Chicago, Milwaukee & St. Paul docks at the same place. The Escanaba docks forwarded over 4¼ million tons of ore last season, from the Menominee and Marquette ranges.

Washington Iron Co.—This Breitung-Kaufman company, operating the Barron mine at Humboldt, where about 175 men are employed, is preparing to sink a shaft at its No. 10 property lying to the east of the Barron mine. A new compressor has been installed.

Oliver—The company is introducing carbide lamps for miners' use underground in its Section 16 mine at Ishpeming. These lamps have been used for several months by the Republic Iron Co., at Republic, where they have given satisfaction. If the trial works out well in the Section 16 mine, the carbide lamp may be generally adopted by the Oliver Iron Mining Company.

Mary Charlotte—This Breitung-Kaufman mine at Negaunee was closed down for 10 days commencing Dec. 25, to permit of rearrangement of sheaves for balanced hoisting, and to add about 35 ft. on the top of the smokestack for better draft. This work is at the No. 2 shaft called the Sunrise shaft.

Duluth Diamond Drill Co.—This company has secured a contract from George Holland, of Duluth, Minn., to drill on the farm of Olaf Helgemo on S. 27—T. 43 N.—R. 34 W., in the Iron River district. This property is situated five miles east of Iron River and is half way between the Chicagon mine of the Munro Iron Mining Co. and the Erickson orebody of the Cleveland-Cliffs Iron Company.

Norman—The company has given an option on 8 forties of land in S. 30—T. 47 N.—R. 30 W., to the Jones & Laughlin Ore Co., which has let a contract to the Cole & McDonald Exploration Co., to put two diamond drills on the tract. The land lies about seven miles northwest of Republic and is crossed by an arm of the Negaunee iron formation which extends quite a distance to the south, finally ending several miles east of Channing. Cole & McDonald only recently finished drilling just north of the Norman tract in the vicinity of the old Magnetic mine, for the Oliver company. In general the ore in the vicinity is hard and is high in sulphur. The Norman Iron Co. is composed of Negaunee men.

Montana

Butte District

Alice—The Sherman law has been invoked by Peter Geddes and other minority stockholders to prevent the absorption of the company by the Anaconda company. Recent testimony in the suit disclosed the fact that $10,500,000 were paid to F. A. Heinze for his holdings at the conclusion of the "copper war" some years ago; also that Ex-Senator Clark received $5,000,000 for the properties that he sold to the Amalgamated two years ago.

Broadwater County

Keating—At the Keating mine of this company in the Radersburg district, a body of high-grade ore has been opened between the 500- and 600-ft. levels, and from the last shipment of eight cars of 50 tons each, returns of about $90 per ton were obtained, which netted the company over $30,000. A large amount of development work has been done in the last six months, particularly on the 600-ft. level, in preparation for increased shipments, and the result is a large amount of ore opened at present.

Butte & Radersburg—The property is being rapidly developed and the management expects to begin shipping soon. A raise is being put up on the ore at present, and the work of sinking a winze, also on the vein, has started. A new surface plant is to be built and the foundations will be laid soon.

Deer Lodge County

Oro Fino—A vein was recently found at this mine in the Georgetown district and development work has opened up 7 ft. of ore running about $17 per ton in gold. The force at the mine has been increased and the ore is being shipped to the Washoe smeltery at Anaconda. The mine has large bodies of low-grade ore and the advent of the Butte, Anaconda & Pacific R.R. into the region will probably make it one of the largest producers in the district.

Fourth of July—This mine on upper Flint Creek has been purchased by John Lawlor and other Anaconda men, and preparations are being made to resume operations soon, after a shutdown of six years. A shaft is down 75 ft., and a well-defined vein is opened at that level. A vein of low-grade ore has also been developed in another part of the mine, which, with shipping facilities can probably be worked at a profit.

JEFFERSON COUNTY

King Solomon—The Calumet & Montana Mining Co. has acquired the King Solomon mine in the Clancy district, 2.5 miles from Clancy. It is a silver property and during the time of the high prices in that metal, it was one of the foremost producers in Montana. Two shafts 100 ft. apart have been sunk on the property; the first was sunk on the vein and 1100 tons of ore are said to have been produced from it, all above the 200-ft. level, which netted $100,000. The second shaft is vertical and levels were established about 50 ft. apart. The formation is a granite similar to the Butte granite, though softer, and is traversed by a porphyry dike 85 ft. wide striking northeast and southwest; the vein is at the contact of the granite and porphyry, averaging from 2 to 22 ft. in width. The company plans to put 40 men to work soon.

Corbin Copper King Mining Co.—This company has been incorporated with a capital of 200,000 shares, par $5, to take over the property of the Montana-Corbin Copper Co. in the Corbin district. The property consists of two claims carrying four veins apexing on them. A shaft has been sunk 450 ft. and levels opened at 150 ft., 250 ft. and the bottom. Some ore has been shipped in the past, the last carload having averaged 12.6% copper, 22 oz. in silver and 60c. per ton gold. The following directors for the new company have been elected: Dr. W. H. Hall, W. D. Gibson, R. B. Nuckols, E. L. Mayo, L. A. Heilbronner, William Gemmel, all of Butte, and Max H. Schultze, of New York. Mining operations will be resumed in the near future, after a shutdown under the old management, in force since June, 1910.

Nevada

CHURCHILL COUNTY

Nevada Hills—It is reported that underground developments below the 470-ft. level, in the vicinity of the principal orebody are encouraging. The oreshoot has not yet been encountered on the 570-ft. level. It is said that the mill is operating satisfactorily and a good extraction is being made.

COMSTOCK LODE

Ophir—The annual report of the superintendent for the fiscal year ended Nov. 30, 1911, shows that the total ore recovery for the year was 15,770 tons of second-class ore, or ore assaying under $60 per ton. The shipments to the Kinkead mill included 14,000 tons of ore yielding per battery sample, $30.62 per ton, or a gross of $428,680, and there was stored in the ore bins on Dec. 1, 1103 tons, assaying $41.09 per ton, or a gross of $45,000. The company also has stored 13,509 tons of tailings, worth $78,000. Two dividends were paid during the latter part of the year, with a good-sized surplus remaining in the treasury. The directors, it is understood, are now considering the advisability of erecting a mill and cyanide plant.

Con Virginia—The southwest prospecting drift on the 2550 level entered into pay ore recently, at a point 370 ft. south from the north boundary line of the mine; mine cars taken from the drift averaged $100 per ton, and 55 cars, $35 per ton. The metallic content of the ore ran nearly 90% in gold. This strike is considered important, as it is in the east fork of the vein, and at a point never before opened up or prospected. The formation is strong and regular and the trend is northeast and southwest, which is characteristic of the Comstock region.

Mexican—The preliminary tests made the last two weeks on the new 100-ton mill indicate that the plant is doing excellent work on low-grade ore, and is rapidly attaining the efficiency required before the regular crushing of ore from the mine starts. The various units recently were brought up to a point of efficiency where a saving of 90% was being secured.

Ward Shaft—A second diamond-drill hole has been driven through the bulkhead on the 2200 level for a distance of 115 ft., without securing an additional flow of water, and it is now proposed to follow up the drill with a drift driven through the bulkhead. Diamond drilling from the raise on the 2000 level will also be started.

Union Consolidated—The north drift on the 2500 level of the mine, being extended from the Mexican side, opened 2 ft. of quartz last week, giving from low to fair assays.

Crown Point—Mill run No. 4 has been completed at the Yellow Jacket mill, and preliminary estimates indicate successful results.

ESMERALDA COUNTY

Goldfield Consolidated—The estimated December production is 29,127 tons yielding $700,000 gross and net $460,000. Operating expenses were $240,000 and Secretary Hews states that the latter included $42,000 for construction.

LINCOLN COUNTY

Bamberger—H. C. Parker, until recently engineer in charge of the Day mine, and Pat Friel, foreman, have secured a lease on this property, immediately adjoining the Day mine. Work has been commenced on the Gusset Patch claim, and shipments will be started immediately, as there are several cars of shipping ore already on the dump.

Home Run—A 15-hp. engine was installed in December on this group of claims, which adjoins the Bristol Consolidated on the west. The property recently changed hands and the new owners are preparing to make shipments from it soon.

Pioche-Demijohn—The property closed down on Dec. 16, pending the completion of the railroad to the Prince mine.

LYON COUNTY

Mason Valley—The new smeltery was blown in on Jan. 6, and it is stated that everything is working satisfactorily.

NYE COUNTY

Tonopah-Belmont—During the quarter ended Nov. 30, the receipts from sales of ore, bullion, etc., amounted to $884,161; mining, milling and administration expenses, $427,114; net profit, $457,046; miscellaneous income, $6625; total net income for quarter, $463,671. Available resources, Nov. 30, 1911, are reported as follows: Due from smelters, $211,756; due from others, $4205; loans on collateral, $150,000; cash in banks, $926,110; amounting to $1,292,072, total.

Montana-Tonopah—A new vein is reported to have been found on the 815-ft. level. The new discovery is northeast of the main shaft and 4 ft. of the vein is said to assay from $80 to $100 per ton.

WHITE PINE COUNTY

Giroux—It is reported that the company has entered into an agreement with the Nevada Consolidated under which the latter will smelt the Giroux ore. Production is expected to start soon.

South Dakota

Homestake—Construction work on the hydroelectric plant has been completed, at an estimated expenditure of $1,250,000, which has been paid out of surplus and current earnings.

Utah

BEAVER COUNTY

Majestic—Settlement has been made by the International Smelting Co. for another car from the Harrington-Hickory mine, on which the returns were as follows: 19.7% lead; 17.7 oz. silver; 0.75% copper; 7.8% iron. This brought net smeltery returns of $21 per ton. Ore carrying 27.3 oz. silver and 8.9% lead has been opened in the west drift, 67 ft. from the shaft. Another car has been shipped.

Utah Mining, Milling & Transportation—Arrangements have been made at the Lady Bryan mine for sinking the main shaft 200 ft. deeper. Conditions are reported favorable.

Horn Silver—A full face of shipping ore has been opened on the 400-ft. level in the northern part of the property. This carries lead, silver and zinc. The extent is not yet known. There is considerable unprospected ground in this vicinity.

Peacock—A lease has been taken on this property from L. F. Block by Salt Lake men.

Indian Queen—Five cars have been shipped recently by leasers.

Nevada-Ready Pay—The new tunnel is in 74 ft. and has opened ore from which assays of 42 per cent. lead, 15 oz. silver and $3 per ton in gold have been obtained.

Juab County

Tintic shipments for the week ended Dec. 22, amounted to 130 cars, which is 35 or 40 cars less than the usual amount. This difference is due to an accident on the San Pedro line, and a consequent shortage of cars.

Iron Blossom—A raise has been driven from the 600-ft. level of the No. 3 shaft in siliceous silver and lead ore. This ore was opened a short distance north of the cave found on the level above and was cut by the raise at about 40 ft.; since then about 15 ft. have been driven in ore. Assays of about 30 oz. silver and $4 in gold have been obtained. Several cars of copper ore have recently been shipped from the south end of the property.

Gemini—Arrangements for leasing the upper levels are in progress, work on company account being below the 900. Everything above the 900 will be turned over to lessees, and a number of blocks of ground have been taken. In the upper levels of the Eureka Hill and Bullion Beck, adjoining, leasers operated at a profit for several years after work on those levels on company account had been suspended.

Opohongo—An option on a block of stock, amounting to nearly 200,000 shares, has been secured by the controlling interests.

Beck Tunnel—A shipment of 100 tons was sent out recently, and the amount of ore showing remains practically unchanged. An incline is being driven south from the tunnel level on the orebody. Drifting is being done from the 175-ft. level of the shaft to cut the new orebody about 100 ft. from the point which is furnishing present shipments.

Yankee—Some difficulty has been experienced in getting cars for shipping low-grade dump ore and the teams, which were hauling, have been laid off temporarily. It is hoped to move this ore while the wagon road between the mine and the railroad is in good condition. Development is in progress on the 1800, 1900 and on a sublevel between the two.

Utah Consolidated—Development is being done northeast of the shaft on the 200-ft. level. The face of the drift is mineralized.

Salt Lake County

Utah Copper—Production in November amounted to 9,117,961 lb. copper, as compared to 8,660,729 lb. in October. The general average for the first nine months of 1911 was 7,957,533 lb. per month. The lowest month was January, the production being 6,707,116 lb. In September, 9,285,581 lb. were produced, this month showing the largest output. Six sections of the Arthur mill have been remodeled and are reported to be doing about 10 per cent. better work than other mills treating disseminated ore. Work is being done on the seventh section and all of the 13 sections will be changed as soon as practicable. The Magna mill is making a good saving, but according to report this is not up to that of the Arthur. The production for the first 11 months of 1911 totaled 89,396,862 pounds.

Ohio Copper—It is reported that the company is installing 64 Wilfley tables for the third section of the mill, which will be commissioned not later than Feb. 1. This will increase the capacity to 3000 tons per day. The Wall rolls will be placed in the crushing department of this section also.

Summit County

Park City shipments for the week ended Dec. 23, amounted to 3,320,160 lb. The shippers were: Daly West, Silver King Coalition, Daly-Judge and Silver King Consolidated.

Daly—Prospecting with a small force is being carried on in various parts of the mine.

Washington

Dead Medicine—This mine, near Colville, Stevens County, has been opened by the Clugston company, and additional machinery will be installed soon.

Lone Pine—A new body of ore has been encountered at this mine, in the Republic district, in Ferry County, assaying from $50 to $115 per ton.

San Poil Consolidated—A contract has been let for the construction of a new mill on this property, at Republic. The mill will have a capacity of 125 tons per day, and is to be completed in about 90 days.

Canada

British Columbia

Le Roi No. 2, Ltd.—Work at depth in the Josie and adjoining property has resulted in the development of the Rodney vein on the 1200-ft. level, and the finding there of a considerable quantity of ore of good grade. The 1300-ft. level is being opened, while preparations are being made to sink still deeper. Indications are favorable to ore being found on and below the 1300 level. During the fiscal year to Oct. 1, 1911, underground development work totaled 5576 ft., while nearly 15,000 ft. of diamond drilling were done. Production was about 27,100 tons of first-class ore, shipped to the smeltery, and 18,400 tons concentrated into 1600 tons. Total marketable metal contents were, approximately: Gold, 25,000 oz.; silver, 24,000 oz.; copper, 905,000 lb. Average value of ore mined was close to that of the previous fiscal year. Concentration operations were successful, and gave the best years' results yet achieved by the works. The company paid the usual dividends.

Ontario

Steel Co. of Canada—This company, at Hamilton, will immediately proceed with the erection of two new openhearth blast furnaces of 50 tons capacity each, a blooming mill, continuous billet mill and a combination rod and bar mill. The contract for the erection of the buildings has been awarded to the Hamilton Bridge Co., which undertakes to have them completed by Apr. 1. The total cost will be about $2,000,000 for these additions.

Ontario—Cobalt

Shipments from Cobalt for the week ended Jan. 6 were as follows: Coniagas, 130,522 lb.; O'Brien, 122,301; La Rose, 63,956; McKinley-Darragh, 63,895; Kerr Lake, 60,570; total, 441,224 lb. Nipissing shipped $33,304 worth of bullion.

Nipissing—During December production amounted to 407,114 oz. worth $225,-156 and ore worth $303,600 was shipped. Of the latter the high-grade mill contributed $267,035. Bullion to the extent of 489,184 oz. was shipped. The production of 407,114 oz. compares with 403,408 oz. for November, 431,986 for October and 436,694 for September. Construction work on the new low-grade mill is progressing satisfactorily. A financial statement as of Jan. 6 gives cash on hand at over $1,500,000, from which the dividend of $450,000, payable Jan. 20, must be deducted.

Cobalt Townsite—During the fiscal year ended Oct. 31, 1911, silver was produced to the net amount of $393,000. A contract is in operation with the Northern Customs mill, at Cobalt, under which the latter is treating 75 tons per day of the Townsite's low-grade ore. The weekly output of the mine is now running about 21,000 oz., and there is ore blocked out estimated to carry about 1,500,000 oz. of silver.

Green-Meehan— The Santa Maria Co., lessee of this property, has shipped a 30-ton car of low-grade ore to Denver. This is the third car sent out since operations were resumed.

Beaver—It is stated that an 8-in. vein, carrying about 3500 oz. of silver per ton, has been encountered in a crosscut on the 400-ft. level.

Beacon—The prospect of the speedy construction of the Elk Lake branch of the Temiskaming & Northern Ontario Ry., has induced the management to order a resumption of operations at this property, at Elk Lake.

ONTARIO—PORCUPINE

Important discoveries of cinnabar in northern Ontario are announced. It is stated to have been found in quantity at Groundhog on the Groundhog River, east of Cochrane, where about 20 locations have been staked. As mercury is employed for the separation of silver from the metals with which the latter is associated, a ready market could probably be found for it, close at hand.

North Dome—The new power house and headframe have been completed, and when the compressor is set up, underground work will be started again. It is reported that the option held by the Temiskaming Mining Co. on this property, may be given up. There has been much dissatisfaction among the Temiskaming shareholders over the deal, and efforts are being made to overthrow the present management.

Gold Wonder—A 3-stamp mill is to be installed on this Swastika property.

Pearl Lake—The last of the electrical equipment for this property has been received, and the new compressor will be started soon. Diamond drilling has been stopped for this season, and further deep exploration work will be carried on from the main shaft at a depth of 400 ft. The shaft is now down 250 ft., and will be continued to the 800-ft. point.

Bewick-Moreing—This company will contract all its underground work in the future.

McEnaney—On this property, under option to the Crown Reserve company, the main shaft is being sunk to 300 ft. Diamond drilling below 400 ft. has shown a large body of quartz, but the assays have not been made public.

Three Nations—A 3-ton shipment has been sent to Montreal, in order to make a test of the ore.

Watson—A small plant will be installed.

Porcupine Gold—Two of the main veins have been cut from the 200-ft. level. Development work will be carried on more vigorously as soon as the new plant is running.

Swastika—The president has issued a statement denying that the mine is flooded.

Caswell—It is stated that this property in the West Shining Tree district has been purchased by Duluth men.

Sakta—This company has made the final payment on its property.

Jupiter—Another payment of $70,000 has been made on this property.

Rea—President Hill states that the pay shoot on the 200-ft. level is 170 ft. long and gives an average assay of $18. This is over a width of 42 in. The vein at the 300-ft. level is 38 ft. wide but the pay shoot has not been definitely found.

Mexico

American Smelting & Refining Co.—The physical condition of the company's mines is stated to be better at present than for several years, and the outlook for increased custom business is bright. All of the five Mexican plants, namely, Monterey, Aguascalientes, Velardena, Matehuala and Chihuahua, are reported to be in operation, also the El Paso plant at the Mexican border. During the political troubles in Mexico some months ago, it was feared that an increase in wages would be necessary both at the mines and smelteries. This was not the case, however, and the labor situation is again normal, with the men working for their usual wages and apparently satisfied.

CHIHUAHUA

Capazuya—This company will hold its annual meeting in January. Stock in a new corporation has been issued *pro rata* to the old stockholders, and a bond issue of $30,000 provided to meet present expenses. Some ore is being taken from a small vein. It is proposed to continue the shaft with the hope of striking the Palmilla orebody at depth. E. M. Pine, of Philadelphia, is secretary.

San Cristobal—This Parral mine is planning a cyanide mill. Recently 600 burros were engaged in transporting ore to the Sierra Plata mill. B. U. Gordon is manager.

Chamaquita—Leasers on this property, east of Palmilla hill, are taking out shipping gold ore. The same oreshoot is being developed on the adjoining Eureka property by a Boston company.

San Juan del Retiro—Negotiations for the sale of this recently developed mine in the Santa Eulalia district are underway with one of the large companies of Mexico.

Compañia Minera La Republica—Milling was resumed at the property on Dec. 22 after a 4 months' shutdown caused by the floods of the last rainy season, and it is expected that normal operations will soon be reëstablished. Gordon Hardy is consulting engineer.

Mololа—A new strike is reported to have been made in the mine recently on the north side of the dike, which cuts the vein. In drifting toward the dike a shoot of ore was uncovered, assaying from $90 to $1800 per ton. The ore in this working has been from 5 to 6 ft. wide and all of shipping grade for some time, but the new shoot is much wider, is of better grade and has indications of permanence. W. M. Matthews, general manager, has 300 mules and burros carrying shipping ore from the mine to Magdalena, the shipping station. The machinery ordered some time ago is expected to be installed within a month, after which the output can be increased. Plans have been made for an aërial tramway to carry the ores from the mines to a central point for milling. Cyanide tests are reported as being conducted by E. M. Hamilton, and this may result in the profitable working of a large tonnage heretofore considered worthless.

Mazata—Carlos Romero, of Etzatlan, a well known mining man in this state, has organized the Compañia Minera de Mazata, to take over and work the old mine in the Etzatlan district. It is said that men identified with the Torreon smeltery and the Mexican National Dynamite Co., also well known residents of Mexico City and Guadalajara, are interested in the new enterprise. The shaft will be sunk 150 ft. further, the water pumped from the old workings and a new hoist installed and the shaft retimbered.

Soledad—Work on the shaft, started about two months ago, is going forward steadily, and about 20 men are employed. This number will be increased later on. The work is in charge of Mr. Bronniman, of Santa Rosalia.

Veta Grande—It is reported that Fred Mitchell, manager, has been transferred to La Reforma property in the State of Coahuila. W. J. Deavitt, formerly in charge of the property and for some time manager of La Reforma, has returned to his former position at this property.

Santo Nino—It is believed that this mine, situated about 2½ miles north of Parral, will soon resume operations. The property was purchased about a year ago from Parral men by Raoul Boutet of Mexico City, on the recommendation of a French engineer, who made an examination.

Amajac—C. A. Sidlers, of Sundberry, secretary and treasurer of the company, is reported to have announced that the company has completed all payments due on the Refugio Las Aninas and Tres Estrellas mines, and the Amajao reduction plant, and that full titles to the properties have been secured. Mine development, curtailed some months ago because of disturbed conditions, has been resumed.

Central America

COSTA RICA

Abangares—A riot recently occurred at this mine, between the white and native employees, resulting in the death of six men.

Asia

CHOSEN

Oriental—During October, the mill treated 31,022 tons of ore yielding $135,493 gross. Operating costs were $71,679; development, improvements, etc., $1375; total net profit, $62,440. During November 27,016 tons were crushed, yielding $137,335 gross. Scarcity of labor caused temporary cessation of milling at times during the month.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Jan. 10—The prevalence of extreme cool and stormy weather over nearly all the country east of the Mississippi has stimulated domestic trade everywhere; at the same time limiting supplies by interfering with transportation. The coal trade everywhere is consequently in an exceptional position and it will be at least a week before it can get back to normal conditions.

Coal and coke tonnage of all the Pennsylvania R.R. lines east of Pittsburg and Erie, 11 months ended Nov. 30, 1911: Anthracite, 10,742,344; bituminous, 38,437,959; coke, 9,728,136; total, 58,908,439 short tons, a decrease from 1910 of 1,139,362 tons, or 1.9 per cent. This loss was entirely in coke, coal showing a gain of 1,157,189 tons.

Exports of fuel from the United States, 11 months ended Nov. 30, 1911, in long tons: Anthracite, 3,312,755; bituminous, 12,880,342; bituminous supplied to steamships in foreign trade, 6,112,769; coke, 835,568; total, 23,141,434 tons. This is an increase of 3,637,436 tons, or 18.6 per cent., over 1910. Canada took in 1911, a total of 13,181,198 tons; Cuba and the West Indies, 1,454,799; Panama, 451,743; Mexico, 449,671 tons.

Imports of fuel into the United States, 11 months ended Nov. 30, 1911, long tons: Anthracite, 54; bituminous, 1,101,228; coke, 65,843; total, 1,167,071 tons. This is a decrease from 1910 of 795,840 tons, or 40.5 per cent. Canada furnished in 1911 a total of 873,265 tons; Australia, 207,945; Japan, 11,273 tons of coal.

Iron Trade Review

New York, Jan. 10—The iron and steel markets have hardly recovered as yet from the holiday break, and conditions are a little slower, as might have been expected. There is not the rush to buy that existed in the closing weeks of last year, and there is a little tendency to revert to small orders. There is still, however, a fair business being done, and no signs of dullness are apparent. Without any boom, it looks as if a good business would continue, and as if January might turn out a good month. There is still some competition for business and prices are not being raised beyond the point they reached 10 days ago.

Holidays at the steel plants were generally short, and many of the mills are at work, with an increased percentage of their capacity.

Orders for rails continue to come in, and there is some increase in demand for other railroad material.

In pig iron, sales have been numerous, but many of them small. The aggregate makes up a pretty good business.

Coke and Ore Rates—Iron and steel manufacturers, operating plants in the Youngstown district in Ohio, have complained to the Interstate Commerce Commission of the rates on coke over the Pittsburg & Lake Erie R.R. from the Connellsville district, and also of the rates on coal over the same road from the Pittsburg district. It is stated that these rates discriminate against the Youngstown district, and reparation is demanded. The same companies have complained in a third statement of the rates on ore over the Lake Shore & Michigan Southern and the Pittsburg & Lake Erie from Ashtabula Harbor, on Lake Erie. Reparation is demanded in this instance also.

Baltimore

Jan. 8—Exports for the week included 5,230,880 lb. rails, 526,820 lb. rail joints, 5,068,953 lb. galvanized iron, 782,452 lb. wire, 662,497 lb. miscellaneous iron and steel and 79,515 lb. tinplates to Valparaiso, Chile; 2,243,100 lb. steel billets to Liverpool. Imports included 1521 tons ferromanganese from Liverpool; 60 casks manganese ore from Hamburg; 13,840 bars spelter from Antwerp; 23,100 tons iron ore from Cuba.

Birmingham

Jan. 8—Inquiries are being received by pig-iron manufacturers in the Southern territory, which promise to result in business. Confidence is expressed by ironmakers in this section as to the prospects, and already there is a steady shipment on orders booked before the close of the past year. It is figured there will be no accumulation of iron during the first half of the year, and if the inquiries now being received result in business, the entire year will be without any surplus iron and what is still on hand will be wiped off. There are two furnaces less in operation in Southern territory now than a month ago, but preparations are being made to make up the difference. The Sloss-Sheffield Steel & Iron Co. is expending something like $150,000 on furnace repairing alone, at Sheffield.

Complaint is still being made by Southern pig-iron manufacturers that the railroads are not offering assistance in the way of freight rates. It is charged that present rates hinder the development of trade in the Central West. This matter is to be carried to the Interstate Commerce Commission.

Cast-iron pipe manufacturers, foundries and machine shops, stove producers, etc., have purchased quite liberally in this territory, and the prospects are for a steady melt of pig iron this year.

There will be no cessation at the steel plants in the Southern territory, business in hand or in sight warranting a steady operation. A large order for rails for the Southern Ry. Co. has just been received at Ensley.

Charcoal iron is in fairly good demand, with $22 the average price being obtained. Scrap is inclined to be slow.

Chicago

Jan. 9—Stock taking is about over, but foundries have hardly yet taken up the burden of 1912 business, and the current demand for pig iron is rather slow, and mostly for small lots. There are inquiries for large lots coming in, but rather slowly. The blizzard weather also has rather depressed trade this week.

Northern No. 2 foundry is still quoted at $14.25@14.75, and there does not seem to be any more $14 iron available. Southern No. 2 holds up to $10.50 Birmingham, or $14.85 Chicago, with some reports of sales at 25c. less. Sellers are inclined to believe that another week will show good business.

Finished-material sales are rather quiet for the week, but with signs of improvement not wanting. Structural business on a large scale is in sight, but much of it may wait until spring is in sight.

Cleveland

Jan. 8—There is talk about ore prices for the coming season, but no action has been taken as yet.

Pig Iron—Business was quiet over the holidays, but there are plenty of inquiries coming in. Prices are unsettled; the tendency is upward, but few actual advances have been made.

Finished Material—Inquiry for plates, sheets and bars is brisk, and mills are inclined to look for a good January busi-

ness. Structural material is quiet for the time being.

Philadelphia

Jan. 10—Pig iron has continued quiet another week. Agents of furnaces report a revival of inquiries during the last two or three days. Prices are firm and confidence prevails. Furnace interests are not running after business and are awaiting the action of buyers who as a rule have a good deal of business on hand and in sight to cover with purchases of iron. The stronger quotations recently established are being adhered to on paper. The large amount of pipe line construction contracted for assures further activity in pipe iron and within a week some of the inquiries then under consideration have resulted in contracts. Low-grade makers are not forcing higher prices and are willing to accept orders for delayed delivery at easy prices. Fresh inquiry for basic developed this week without reported transactions. The inquiries for No. 2X foundry come in the main from the smaller consumers. Certain large consumers have signified their willingness to duplicate December orders at concessions of about 25c. In forge irons the tone is strong. Everything is favorable for an enlarging demand in all lines. Quotations are $15 for No. 2X foundry; $14.50 for best forge; same for basic.

Steel Billets—Both forging and rolling billets have moved up a trifle and a fair amount of business has been closed.

Bars—Bars remain at the fractional advance on small lots and it is claimed that even in large quantities the present negotiations will be closed at a slight improvement. Jobbers are more active in replenishing depleted stock and car-building requirements are looming up.

Sheets—Sheet quotations are held firmly and large buyers are not as able as they thought they would be to close contracts on early December quotations. The small-fry buyers order readily and without question, but they are ordering only for current necessities. Sheets have reached permanently a better position.

Pipes and Tubes—Some business that was counted on for December in tubes has just come along. Merchant pipe is strong. Cast-pipe work is abundant.

Plates—Shipbuilding orders throw in steadily for rather small quantities, each new job of work being covered and no more. The slight advance made a few weeks ago is being held. The mills have a larger accumulation of business than for many months.

Structural Material—Quite an amount of business for bridge and other work has reached the mills within a few days.

Scrap—Sales of scrap have fallen to small lots, but all the dealers are holding firmly to announced prices.

Pittsburg

Jan. 9—The past fortnight in the steel trade has been quiet by comparison with the activity of a few weeks preceding, in which period the tone of the market underwent a complete change. There has been a decided disposition to magnify the importance of the change which has occurred. It does not, as a matter of fact, leave the steel industry in a greatly changed condition. The change in the position covers simply: (1) A material increase in the tonnage of steel products actually specified on mill books, whereby the mills can arrange their rolling schedules to better advantage, and have work assured for several weeks; (2) an advance of $1@3 a ton in quotable prices of several important steel products, although the material to be rolled and delivered is at the old and lowest prices.

Already information is coming out that buyers have contracted for more than their normal requirements for the first quarter of the year, in order to take advantage of the low prices, but fully expecting to string out the deliveries to cover a longer period, and by the amount that such business is done, the position of the mills, as shown by figures of contracts they have booked, is inflated.

There is an increase in production this month over December, buti tt is confined almost entirely to the Steel Corporation in western Pennsylvania and Ohio, this increase being due chiefly to the needs of the car plants. The Jones & Laughlin Steel Co. this week began making steel at its new Aliquippa plant. The tinplate and wire departments at Aliquippa have been in operation for some time, but until yesterday no steel had been made there. One of the four 250-ton Talbot open-hearth furnaces was started, it being likely that the other three will be started by the end of the month, their rated capacity being about 30,000 tons of steel ingots monthly. The furnaces are being operated on the pig and scrap process, rather than on the regular Talbot process.

Pig Iron—The Alleghany Steel Co. is understood to have purchased between 6000 and 9000 tons of basic iron, for delivery over the first six months of the year, at a trifle under $12.50, Valley furnaces. The Pittsburg Steel Co. recently bought about 15,000 tons of basic iron for January delivery, the major part, if not all of the iron, to come from a furnace outside the Valleys. Bessemer and foundry iron have been quiet. The pig-iron averages for December, compiled by a trade interest from actual sales, have been aunounced at $14.19, Valley, for bessemer, and $12.44, Valley, for basic, showing increases over November of 17c. in bessemer and 16c. in basic. The basic average is considerably higher than the average quoted price during December. Current quotations are: Bessemer, $14.25; basic, $12.35@12.50; No. 2 foundry, $13; malleable, $12.75@13; forge, $12.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market has been quiet, consumers having covered before the recent advance, which appears to be well held, and we quote prompt and forward at $41, Baltimore.

Steel—The majority of the mills are comfortably sold up for this month and next on both billets and sheet bars, and one large mill is reported to be oversold. Prices are fairly well held at the sharp advance which has occurred, although it is possible one or two mills would shade them for delivery at certain points. We quote: Billets, $20; sheet bars, $21; rods, $24.50@25, Pittsburg.

Sheets—Mills are holding firmly to the advanced prices, and here and there a mill asks $1 over the regular market, being sufficiently well sold up to allow orders to pass by for a time. Specifications have been good, but almost wholly against contracts taken at the lowest points. The market is quotable at 1.90c. for black sheets, 28 gage; 2.90c. for galvanized, 28 gage, and 1.40c. for blue annealed, 10 gage. Corrugated roofing is selling at concessions of $2 a ton from the old list, of June 1, 1911, which makes painted corrugated about $1.33 per square for 28 gage and galvanized $2.46 per square.

St. Louis

Jan. 8—Quite an improvement has been noted with the advent of the new year, and a number of producers and jobbers are quoting $10.50, Birmingham, or $14.25, St. Louis, as the minimum price on No. 2 foundry, though a few quotations have gone out at a little under this figure for immediate acceptance. Demand for finished products is much better; a number of good orders have been received in the last 30 days, which will keep the plants working nearly full time from now on. There has been some inquiry for Northern iron and a little business done. The current figure on northern No. 2 is around $15, St. Louis, though some has gone at $14.75 to meet competition.

Iron Ore Trade

The Port Boliver Iron Ore R.R., into Ore City, Tex., has been completed, thereby connecting the ore lands of the eastern part of Texas with the coast. This affords a means whereby the iron ore mined in that part of the state can be shipped directly to Boliver, Tex., a seaport, from where it can be taken by steamship to Atlantic Coast points. Development is proceeding at the mines.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel and of machinery in Germany, 11 months ended Nov. 30, metric tons:

	Exports	Imports	Excess
Iron and steel	4,834,865	540,747	Exp. 4,294,118
Machinery	414,368	70,735	Exp. 343,633
Total	5,249,233	611,482	Exp. 4,637,751
Total, 1910	4,754,409	574,721	Exp. 4,179,688

Exports of iron ore in 1911 were 2,389,046 tons; imports, 10,007,349 tons.

British Foreign Trade—Exports and imports of iron and steel, and of machinery, in Great Britain, 11 months ended Nov. 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£40,030,465	£10,134,810	Ex. £29,895,655
Machinery	28,326,500	5,315,556	Ex. 23,010,944
Cutlery and hardware	9,344,333	6,063,283	Ex. 3,281,050
New ships	4,888,032	.....	Ex. 4,888,032
Total	£82,589,330	£21,513,649	Ex. £61,075,681
Total, 1910	84,127,249	17,907,976	Ex. 66,219,273

Decrease in exports in 1912 was £1,537,919, or 1.8 per cent. Iron and steel, with machinery, showed a considerable increase, but there was a decrease of £3,752,824 in the value of new ships built for foreign countries. Increase in imports in 1912 was £3,605,673, or 20.1 per cent. The quantities of iron and steel were, in long tons:

	1910	1911	Changes
Exports	4,215,621	4,108,991	D. 106,630
Imports	1,218,394	1,604,102	I. 385,708

Imports in 1912 included 21,038 tons steel billets, 440,123 tons blooms, billets and slabs and 290,641 tons sheet bars and tinplate bars; a total of 751,802 tons of half-finished material, largely from Germany and the United States.

METAL MARKETS

New York, Jan. 10—The metal markets generally have been inclined to quiet, but show considerable strength.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910	1,376,011	4,313,500	Imp. 2,937,489
Year 1911	36,188,397	52,737,854	Imp. 16,549,457
" 1910	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911	5,052,238	3,338,956	Exp. 1,713,282
" 1910	5,265,595	4,827,254	Exp. 438,341
Year 1911	59,667,286	40,439,844	Exp. 19,227,442
" 1910	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Jan. 6: Gold, $93,014; silver, $1,412,012, principally to London. Imports: Gold, $74,942; silver, $222,855, from the West Indies, Mexico and South America.

Gold—Prices of gold on the open market in London were at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York a total of $2,700,000 gold was taken, on London account, for shipment to Argentina.

Iridium—Prices are unchanged, at $64 per oz. for pure metal.

Platinum—Trade is quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Dec. 24, that as usual at this season the small producers, needing money for the holidays, have been pressing their platinum for sale, and this has a relaxing influence on the market. Prices are nominally unchanged. Quotations for small lots of crude metal, 83 per cent. platinum, at Ekaterinburg are 10 rubles per zolotnik—equal to $37.60 per oz., for large lots at St. Petersburg, 38,500 rubles per pood—$37.73 per oz.—for the same grade.

Silver—The market has scarcely maintained itself at the advance and today shows a slight recession. The prospects for the New Year for silver are considered good, taking into account the many influences likely to bear on the situation.

SILVER AND STERLING EXCHANGE

Jan.	4	5	6	8	9	10
New York	54⅜	55	55	55	55	54⅞
London	25-1/16	25⅜	25⅜	25⅜	25⅜	25-1/16
Sterling Ex.	4.8640	4.8645	4.8660	4.8665	4.8675	4.8680

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Dec. 28, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£7,168,200	£8,769,700	I. £1,601,500
China	1,424,000	990,300	D. 433,700
Total	£8,592,200	£9,760,000	I. £1,167,800

India Council bills in London averaged 16.04d. per rupee for the week.

Stocks of bars in Bombay are estimated at £1,580,000; of sycee and bars in Shanghai, £3,200,000; a total of £4,780,000. Besides these there is a stock of about £1,900,000 in London.

The Treasury Department estimates gold in the United States, Jan. 2, 1912, as follows: Held against gold certificates, $1,010,956,369; in Treasury current balances, $172,017,641; in circulation, $614,026,906; total, $1,797,000,916. Gold held against certificates includes bullion as well as coin.

Coined silver in the United States, Jan. 2, is estimated by the Treasury Department as follows: Standard dollars, $565,186,367; subsidiary coin, $165,789,312; total, $730,975,679. Of the silver dollars, $489,166,000 are held in the Treasury against silver certificates outstanding.

The Ansonia Brass & Copper Co., of Ansonia, the Benedict & Burnham Manufacturing Co., of Waterbury, the Coe Brass Manufacturing Co., of Torrington and Ansonia, and the Waterbury Brass Co. went out of business Jan. 1, and their operations, plants and good-will were taken over by the American Brass Co. By this process the American Brass Co., instead of controlling these companies as it has in the past, through stock ownership, will consolidate the entire business in its own hands.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
4	14.20 @14.40	14.05 @14.10	42½	4.45	4.30 @4.35	6.30 @6.45	6.15 @6.30
5	14.30 @14.40	14.10 @14.15	43⅛	4.45	4.30 @4.35	6.30 @6.45	6.15 @6.30
6	14.30 @14.40	14.10 @14.15	43	4.45	4.30 @4.35	6.35 @6.45	6.20 @6.30
8	14.30 @14.50	14.20 @14.30	42¾	4.45	4.30 @4.35	6.40 @6.50	6.25 @6.35
9	14.30 @14.50	14.25 @14.35	42¼	4.45	4.30 @4.35	6.40 @6.55	6.25 @6.40
10	14.30 @14.50	14.20 @14.30	42	4.45	4.30 @4.35	6.40 @6.55	6.25 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
4	63⅜	64⅛	67½	191¾	186½	15⅝	26¾
5	63⅝	64⅜	67¾	194	189½	15⅝	26¾
6	.....	.....	.....	.....	.....	.....	.....
8	64-3/16	64-1/16	68¼	193	188	15⅝	26¾
9	64⅛	64⅞	68¼	191½	186½	15-1/16	26¾
10	63	63¾	67½	190½	185¾	15⅝	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The expectation of favorable statistics started a heavy buying movement, and a fairly large volume of sales was made to European and domestic buyers at advancing prices. Electrolytic producers finally raised their price asked to 14½c., delivered, usual terms, and

some Lake producers actually realized a full 14½c. price, although in both kinds of metal there were cheaper sellers at all times. When the statistics were published on Jan. 9, showing a reduction in the stocks of over 22,000,000 lb., it appeared that the good news had been discounted. This made itself felt by heavy liquidation in the standard market, which, after reaching £64 5s. for spot and £65 for three months on Jan. 9, reacted sharply on Jan. 10, the close being cabled at £63 for spot and £63 15s. for three months. This naturally had an effect upon the market for refined sorts and more competition to sell promptly developed with the result of a shading of prices, although quotations were not materially reduced. The close is nominal at 14.30@14.50c. for Lake copper, and 14.20@14.30c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14@14⅛c. as the average for the week.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is higher at 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 6865 long tons. Our special correspondent gives the exports from Baltimore at 2922 tons.

Tin—The demoralization of last week's London market is being ascribed to the difficulties of one of the London metal houses which led to its failure. Since then the market has steadied. Advantage was taken by domestic consumers and dealers of the severe decline in the London market, and considerable business placed, especially for future deliveries. Spot tin is exceedingly scarce, the bulk of the material being in the hands of consumers. For what little is being required, premiums up to 1½c. per lb. have to be paid. The market closes weak at £190 10s. for spot and £185 15s. for three-months tin in London, and about 42c. for January tin here.

Lead—The market is unchanged at 4.45c., New York, and somewhat easier at 4.30@4.35c., St. Louis.

The London market has been steady, and the close is cabled at £15 12s. 6d. for Spanish lead, and £15 15s. for English.

Spelter—There has been a rather better demand, not only for near-by shipment, but in some directions consumers have made up their minds that it appears advisable to anticipate their requirements for the future, so as to avoid the necessity of paying premiums for early shipments, such as have been prevailing for some time past. Futures are still obtainable at a considerable discount, causing a wide spread in prices, the close being firm at 6.25@6.40c., St. Louis, and 6.40@6.55c., New York.

The London market is unchanged and steady at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business has been only on a moderate scale, though prospects are better. Quotations are unchanged, at 18½@19c. for No. 1 ingots, New York delivery.

Antimony—Business has been on a fair scale and prices are steady. Cookson's is quoted at 7¾@7⅞c. per lb. and Hallett's at 7⅜@7⅝c. For Chinese, Hungarian and other outside brands 6¾@7c. is named.

Quicksilver—The market is rather quiet and prices are a shade weaker. The New York quotation is $43 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $42.50 per flask for domestic business and $40 for export. London price is £8 per flask, with the same figure quoted by jobbers.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, 11 months ended Nov. 30, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	323,502	137,655	Exp. 185,847
Copper, 1910....	281,405	138,360	Exp. 143,045
Tin, long tons....	980	43,555	Imp. 42,575
Tin, 1910.....	599	43,985	Imp. 43,386
Lead, short tons.	95,811	81,533	Exp. 14,278
Lead, 1910.....	65,339	96,892	Imp. 31,553
Zinc, short tons..	5,292	1,340	Exp. 3,952
Zinc, 1910.....	3,453	3,139	Exp. 314
Nickel, lb.....	22,780,453	26,716,643	Imp. 3,936,190
Nickel, 1910....	13,694,344	29,359,544	Imp. 15,665,200
Antimony, lb.....	160,844	9,860,037	Imp. 9,699,193
Antimony, 1910.	296,970	9,248,138	Imp. 8,951,168
Platinum, oz.....	95	110,937	Imp. 110,842
Platinum, 1910.	47	112,048	Imp. 112,001
Aluminum, value	$1,101,491	.....	Exp. $1,101,491
Aluminum, 1910	811,217	.....	Exp. 811,217
Ores, etc.			
Zinc in ore, lb...	19,439,638	34,734,814	Imp. 15,295,176
In ore 1910....	8,964,028	48,403,850	Imp. 39,439,822
Zinc oxide, lb. ..	26,459,582	.....	Exp. 26,459,582
Zinc oxide, '10..	24,306,841	.....	Exp. 24,306,841
Zinc dross, lb....	8,385,103	.....	Exp. 8,385,103
Zinc dross, '10..	8,850,394	.....	Exp. 8,850,394
Chrome ore, l.t..	5	37,529	Imp. 37,524
Chrome ore, '10	30	38,579	Imp. 38,549

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1911 was 52,956 tons; exported, 16,356 tons. Imports of aluminum July 1 to Nov. 30, 1911, were 2,912,018 lb.; not reported previous to July 1, 1911. The metal exports given above include reëxports of foreign material.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 6—This week has been similar to the first week of 1911, both years beginning with a blizzard and zero weather that put a stop to mining operations. The past two days the blizzard has raged with a fury seldom recorded here, with the thermometer ranging from zero to 6 deg. below. The highest price for zinc sulphide ore was $48 per ton, the base per ton of 60 per cent. zinc $42@45. Zinc silicate sold at $24@26 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $42.92. The highest price paid for lead ore was $62 per ton for a couple of carloads, the general market ranging close to $60, with the average for all grades of lead ore $59.14 per ton.

The corrected shipments for 1911, adding the last week in December were as follows: Blende, 502,542,050 lb., value $10,269,902; calamine, 36,113,710 lb., value $548,684; lead ore, 91,185,340 lb., values $2,612,781; total value $13,431,467 for the year.

SHIPMENTS, WEEK ENDED JAN. 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,119,210	.....	649,910	$86,559
Joplin.....	1,814,250	.....	210,210	45,310
Cave Springs.	1,123,140	.....	.....	25,830
Alba-Neck.....	837,370	.....	.....	18,422
Duenweg.....	712,910	65,240	.....	16,238
Galena.....	387,740	.....	76,020	10,650
Carl Junction	279,100	.....	.....	6,690
Oronogo.....	85,630	.....	177,920	6,534
Lawton	186,040	.....	.....	4,000
Carthage ...	146,240	.....	.....	3,071
Miami.....	169,990	.....	.....	3,060
Granby	29,380	142,040	9,790	2,940
Jackson.....	113,840	.....	.....	2,445
Spurgeon	56,810	65,600	.....	2,055
Badger.....	65,280	.....	.....	1,370
Quapaw.....	54,840	.....	.....	1,095
Totals.....	9,181,770	272,880	1,123,850	$236,269
Same week last year...	6,638,480	.....	942,990	$164,685

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January.....	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February....	40.69	40.21	39.47	39.16	53.64	54.46
March.....	43.60	39.85	39.71	38.45	51.26	54.57
April.....	41.00	38.88	39.33	37.47	49.72	56.37
May.....	40.19	38.25	37.51	36.79	48.16	55.21
June.....	40.20	40.50	37.83	38.18	48.80	56.49
July.....	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September..	43.45	42.63	39.96	41.29	54.73	59.33
October.....	43.31	42.38	40.50	40.89	53.18	54.72
November...	47.20	45.40	43.20	43.25	54.80	57.19
December...	42.50	44.13	40.70	40.76	55.70	62.03
Year.....	$42.43	$41.45	$39.79	$39.90	$52.12	$56.76

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Jan. 10—The general markets have not yet recovered from the holiday dullness.

Copper Sulphate—Business is fair and prices unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Arsenic—Quiet, but rather firm at $2.25 per 100 lb. for white arsenic.

Nitrate of Soda—There is no change in the position. Quotations continue 2.20c. per lb. for both spot and futures.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate.....cwt.	3.10@3.15
Arsenic, white.....lb.	0.02½@0.02¾
Barytes, ground.....sh. ton	12.00@13.00
floated.....sh. ton	14.00@17.00
Calcium acetate, gray.....cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls, sh. ton	70.00
Carbons, good drill quality, carat	50.00@75.00
Cement, Por't., Am....400-lb bbl.	1.33
Chrome brick, f.o.b., Pittsburg, M	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk.....cwt.	0.55
bbl.....cwt.	0.65@0.85
Copper sulphate.....cwt.	4.90@5.15
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9.00
Magnesite, crude, 95%....lg. ton	7.50@8.50
calcined, powdered..	26.00@35.00
brick, dom., f.o.b. Pittsburg.....M	160@200
Paints, litharge, Am. powd....lb.	0.05½@0.06
red lead, American....lb.	0.06½@0.07
white lead, Am., dry..lb.	0.05½@0.05¾
zinc white, Am., dry..lb.	0.05¾@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%.....	5.75@6.25
land pebble 68%.....	3.70@3.80
†Tenn., 78@80%.....	5.00@5.50
75%.....	4.75@5.00
68@72%.....	4.25@4.50
‡So. Car. land rock 60%.....	3.50@3.75
Potassium cyanide, 98@99%..lb.	0.18@0.20
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines.....	0.10@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit..	0.13@0.13¼
Imported, arsenical, furnace size, ex-ship, per unit..	0.12½@0.12¾
Imported, fines, arsenical, ex-ship.....	0.11½@0.12
Imported, fines non-arsenical, ex-ship, per unit.....	0.12½
Sodium cyanide, 120 to 130% KCN.....lb.	0.18@0.20
nitrate 95% spot....cwt.	2.20
95% future..cwt.	2.20
Sulphur, Louisiana prime, N. Y., lg. ton	22.00 up
roll.....cwt.	1.85@2.15
flour.....cwt.	2.00@2.40
flowers, sublimed...cwt.	2.20@2.60
pow. com., bags....cwt.	1.50
Sicilian, crude brimstone.....lg. ton	22.50
Zinc chloride, granular.....lb.	0.04½@0.04½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

Pipe line runs from the wells of New York, Pennsylvania, West Virginia, Kentucky, Tennessee, Ohio and Indiana in December are reported by the *Oil City Derrick* at 3,916,176 bbl. Shipments were 5,580,223 bbl. for the month.

MINING STOCKS

New York, Jan. 10—On Thursday, Jan. 4, the general stock markets were moderately active and gradually firm. Steel Corporation stocks were steady. On the Curb, mining stocks were rather active. Cobalt shares were steady and several of the copper stocks gained fractionally.

On Friday, trading on the Exchange was lighter and there were fractional declines in several leading stocks. Steel Common held its own, but Utah Copper lost a fraction. On the Curb trading was generally quiet; the copper stocks were in demand, with small gains in most of them.

On Saturday—the short session—trading was light and price changes were small. The Curb did some business in coppers. There were sales of Homestake at $87@88.50 per share.

On Jan. 8 the general market was again rather slow and showed no definite tendency. Mining shares were not active on the Curb, except Inspiration Copper, which sold freely under the effect of the new consolidation. Porcupine stocks were also sold freely.

On Jan. 9 and today the business both on the Exchange and the Curb was seriously impeded by the burning of the Equitable Building, tying up several banks and the safe-deposit concerns in which a great variety of stocks was deposited. The business was not at all on a normal basis.

Sales of mining stocks on the New York Curb market in 1911: Total transactions in mining shares are estimated at only 11,772,314 shares, less than one-third of the business done in this department in the previous year and a little more than one-fifth of the transactions in 1909.

Boston, Jan. 9—Copper shares reflect the advancing metal market moderately, yet the response from the public is not as great as conditions warrant. Considerable profit-taking has been done, causing a more or less reactionary tendency. Mayflower and Old Colony mining issues have been by all odds the features. The former has risen $5 to $8.25 and the latter $4.12½ to $6.75. Trading in each has been of large proportions, due to important discoveries with drill cores in the Mayflower within 60 ft. of the Old Colony property. The lode encountered in the Mayflower is said to be of great thickness and is expected to be found also in the Old Colony.

North Butte still continues a mystery, marketwise, and on heavy trading shows slight price changes from day to day. Inspiration has been conspicuously active, but with very slight fluctuations. The new Inspiration Consolidated stock received an initial quotation on the Curb at $21.37½, when issued. The offer to take over Inspiration at $10 and Live Oak at $40 per share by the new company is receiving liberal support. The banking support behind this new company is a good asset.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda.....	21,400,000	20,850,000	.....
Arizona, Ltd.....	2,720,000	2,960,000	3,100,000
Balaklala.....	.....	.....	.....
Copper Queen.....	7,786,218	6,946,775	.....
Calumet & Ariz....	4,784,000	4,390,000	4,486,000
Detroit.....	2,086,624	1,941,498	.....
East Butte.....	920,000	983,405	.....
Mammoth.....	1,865,846	1,793,181	.....
Miami.....	.....	.....	2,500,000
Nevada Con.....	5,547,931	5,207,983	.....
Old Dominion.....	2,050,000	2,082,000	2,610,000
Roy.....	2,069,287	2,517,000	2,660,000
Shannon.....	1,124,000	1,256,000	.....
South Utah.....	326,578	361,681	.....
United Verde*.....	2,750,000	2,500,000	.....
Utah Copper Co....	8,660,729	9,117,961	.....
Lake Superior*....	18,440,000	18,600,000	.....
Non-rep. mines*...	13,564,713	11,483,000	17,500,000
Total production.	98,800,728	94,265,139	.....
Imports, bars, etc..	22,960,027	17,224,725	.....
Total blister.....	121,760,755	111,489,864	.....
Imp. in ore & matte	4,137,431	4,767,217	.....
Total....	125,898,186	116,257,081	.....
Brit. Col. Cos.:			
British Col. Copper	778,586	.....	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo.....	1,245,440	.....	.....
Cananea	5,804,000	.....	3,706,000
Moctezuma	1,719,643	1,682,768	.....
Other Foreign:			
Cape Cop., S. Africa	.....	857,920	.....
Spassky, Russia....	672,000	685,440	.....
Famatina, Argen..	.....	174,720	.....
Exports from:			
Chile.....	4,816,000	4,704,000	.....
Australia.....	7,056,000	7,168,000	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910....	1,452,122,120	749,426,542	722,431,494
I, 1911.....	115,696,591	42,078,557	53,208,739
II.....	109,828,297	50,518,998	45,111,019
III.....	130,532,080	66,080,789	59,081,127
IV.....	118,085,223	52,407,650	62;129,599
V.....	126,962,544	64,543,963	61,978,557
VI.....	124,554,312	61,655,561	71,460,519
VII.....	112,167,934	56,982,582	74,880,658
VIII.....	125,493,667	59,935,364	69,855,660
IX.....	115,588,950	57,311,584	50,824,011
X.....	118,255,442	64,068,307	60,084,349
XI.....	111,876,601	68,039,776	67,049,279
XII.....	122,896,697	65,988,474	79,238,716
Year, 1911...	1,431,938,338	709,611,605	754,902,233

	VISIBLE STOCKS		
	United States	Europe	Total
I, 1911.....	122,030,195	236,629,120	358,649,373
II.....	142,439,490	236,992,000	379,431,134
III.....	156,637,770	233,385,600	390,023,009
IV....	162,007,934	223,014,400	385,022,434
V.....	165,555,908	212,284,800	377,840,708
VI.....	165,995,932	202,540,800	368,536,732
VII.....	157,434,164	195,932,800	353,366,964
VIII.....	137,738,858	191,891,840	329,630,698
IX.....	133,441,501	191,228,800	324,670,301
X.....	140,894,856	191,945,600	332,840,456
XI.....	134,997,642	176,825,600	311,823,242
XII.....	111,785,188	164,281,600	276,066,788
I, 1912.....	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Rhode Island Coal and United Verde Extension have been the Curb features. The former broke to 40c. per share, while the latter rose. A reorganization plan for the Rhode Island Coal Co. is expected to be announced shortly.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22		$1.00
Belcher, Nev	Jan. 3	Jan. 24	0.10
Black Jack, Utah	Feb. 6		0.01
Boston Ely, Nev	Jan. 18		0.50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0.02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Chollar, Nev	Jan. 3	Jan. 26	0.10
Confidence, Nev	Jan. 16	Feb. 6	0.20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Con. Virginia, Nev	Dec. 16	Jan. 6	0.25
Federal Ely, Nev	Jan. 5	Jan. 27	0.01
Fetish, Ida	Jan. 5	Jan. 23	0.001½
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Hancock Con., Mich	Jan. 10		1.00
Julia, Nev	Dec. 28	Jan. 16	0.05
Kentuck Con., Nev	Jan. 9	Jan. 26	0.05
Ojibway, Mich	Jan. 10		1.00
Raven, Mont	Feb. 1		0.10
San Antonia, Mex	Nov. 20		0.50
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Southwestern Miami, Ariz.	Jan. 15		1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Standard, Utah	Jan. 8	Feb. 5	0.005
Utah, Nev	Jan. 19	Feb. 9	0.05
Victoria, Mich	Aug. 21		1.00
Winona, Mich	Nov. 10		1.00
Wyandot, Mich	Dec. 14		1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635	55.719	23.351	25.680	25.649
December	52.226	54.428	54.905	24.030	25.160	25.349
Total	51.502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.600
February	13.332	12.256	13.719	12.611	59.388	54.974
March	13.255	12.139	13.586	12.447	59.214	54.70⅞
April	12.733	12.019	13.091	12.275	57.238	54.034
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.365
July	12.215	12.463	12.570	12.720	54.194	56.673
August	12.490	12.405	12.715	12.634	55.733	56.266
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.170
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	13.552	12.863	13.768	56.769	62.068
Year	12.738	12.376	13.039	12.634	57.054	55.973

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.403	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	43.125
June	32.769	44.606	December	38.199	44.655
			Av. Year	34.123	42.281

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.260
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442	4.298	4.314	4.181	13.217	15.821
December	4.500	4.450	4.363	4.332	13.197	15.648
Year	4.446	4.420	4.312	4.286	12.920	13.970

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976	6.380	5.826	6.223	24.083	26.795
December	5.624	6.301	5.474	6.151	24.019	26.849
Year	5.520	5.758	5.370	5.608	23.050	25.281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.96	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84	14.92	14.26	13.30	14.78	14.25
December	15.90	15.15	14.15	13.10	14.65	13.90
Year	$17.10	$15.72	$15.65	$13.94	$15.83	$14.49

STOCK QUOTATIONS

COLO. SPRINGS Jan. 9

Name of Comp.	Bid.
Acacia	.04⅜
Cripple Cr'k Con.	.02⅜
C. K. & N.	.15
Doctor Jack Pot	.06¼
Elkton Con.	.69½
El Paso	.70⅛
Findlay	.06
Gold Dollar	.17
Gold Sovereign	.02⅜
Isabella	.17⅜
Jack Pot	.06⅜
Jennie Sample	.06½
Lexington	.01½
Moon Anchor	.01½
Old Gold	.03
Mary McKinney	.52
Pharmacist	.02½
Portland	.90
Vindicator	.68
Work	.03½

SALT LAKE Jan. 9

Name of Comp.	Bid.
Beck Tunnel	.12
Black Jack	.09½
Carisa	.17
Cedar Talisman	.03½
Colorado Mining	.30½
Columbus Con	.23
Daly-Judge	5.20
Grand Central	.70
Iron Blossom	1.05
Little Bell	.30
Lower Mammoth	.02½
Mason Valley	11.50
May Day	.13½
Nevada Hills	2.50
New York	.07
Prince Con	.82
Silver King Coal'n	1.60
Sioux Con	.11
Uncle Sam	.23
Yankee	12.24

TORONTO Jan. 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.50	Pearl Lake	.36
Hudson Bay	80.00	Porcu. Gold	.55⅜
Temiskaming	.35	Porcu. Tisdale	.03½
Wettlaufer-Lor	.80	Preston E. D.	.10½
Apex	.08	West Dome	.70
Central	3.50	Standard	.19½
Dobie	.80	Foley O'Brien	.35½
Dome Exten	.45½	Rea	1.79
Hollinger	13.10	Crown Chartered	.49
Imperial	.07	Swastika	.22

SAN FRANCISCO Jan. 9

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.02
Belcher	.60
Best & Belcher	.19
Caledonia	1.27
Challenge Con	.15
Chollar	.15
Confidence	.40
Con. Virginia	1.15
Crown Point	.60
Gould & Curry	.05
Hale & Norcross	.19
Mexican	4.22½
Occidental	.50
Ophir	1.52½
Overman	1.07½
Potosi	.05
Savage	.20
Sierra Nevada	.28
Union Con	1.07½
Yellow Jacket	.50

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	7.95
Jim Butler	.35
MacNamara	.26
Midway	.21
Mont.-Tonopah	1.05
North Star	.26
West End Con	.75
Atlanta	.18
Booth	.06
C.O.D. Con	.13
Comb. Frac	.13
Jumbo Extension	.22
Pitts.-Silver Peak	1.30
Silver Pick	.06
St. Ives	.30
Tramps Con	.01
Argonaut	‡3.40
Bunker Hill	‡3.00
Cent. Eureka	.40
So. Eureka	‡6.00

N. Y. EXCH. Jan. 9

Name of Comp.	Clg.
Amalgamated	65
Am. Agri. Chem	62
Am.Sm.&Ref.,com	71⅝
Am. Sm.& Ref., pf.	103
Am. Sm. Sec., pf. B	86⅛
Anaconda	36⅜
Batopilas Min	1⅜
BethlehemSteelpf	61⅛
Chino	26
Federal M.& S., pf.	38
Goldfield Con	4⅛
Great Nor., ore ctf.	41
Homestake	88½
Miami Copper	24¾
Nat'nalLead,com.	51⅛
National Lead, pf.	106¼
Nev. Consol	19½
Pittsburg Coal, pf.	82
Ray Con	18
RepublicI&S,com	25¼
Republic I & S, pf.	85¼
SlossSheffi'd,com.	41
Sloss Sheffield, pf.	108¼
Tennessee Copper	38
Utah Copper	56⅜
U. S. Steel, com	66
U. S. Steel, pf.	110⅛
Va. Car. Chem	52⅜

BOSTON EXCH. Jan. 9

Name of Comp.	Clg.
Adventure	6⅛
Algomah	5⅜
Allouez	44
Am. Zinc	26⅜
Ariz. Com., ctfs.	2⅝
Bonanza	.46
Boston & Corbin	7⅝
Butte & Balak	4½
Calumet & Ariz	61¼
Calumet & Hecla	443
Centennial	18
Con. Mercur	.03
Copper Range	56
Daly West	5⅝
East Butte	12¾
Franklin	11¾
Granby	37½
Hancock	29⅝
Hedley Gold	15½
Helvetia	1½
Indiana	14½
Island Cr'k, com.	41¼
Isle Royale	22
Keweenaw	1¼
Lake	36
La Salle	5½
Live Oak	41½
Mass	8¼
Michigan	2½
Mohawk	58⅛
New Arcadian	4
New Idria Quick	8½
North Butte	27⅛
North Lake	6¼
Ojibway	5
Old Dominion	47
Osceola	109¼
Parrot	14⅜
Quincy	76
Shannon	10½
Shattuck-Ariz	19
Superior	28½
Superior & Bost.	4
Tamarack	31⅜
Trinity	5⅜
Tuolumne	3⅜
U. S. Smelting	35¾
U. S. Smelt'g, pf.	48
Utah Apex	3¼
Utah Con	16¾
Victoria	4¾
Winona	6¼
Wolverine	101
Wyandot	2

N. Y. CURB Jan. 9

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.41
Braden Copper	5⅜
B. C. Copper	4¼
Buffalo Mines	1.50
Butte & Vipond	.53
Butte Coalition	22⅞
Cobalt Central	.01
Con. Ariz. Sm.	⅜
Davis-Daly	1/16
Diam'field-Daisy	13
Ely Con	9/16
Florence	.61
Giroux	4 11/16
Gold Hill Con	‡1/16
Greene Cananea	8½
Greenwater	.06
Guggen. Exp	184
Inspiration	10⅛
Internat. S. & R.	‡124
Kerr Lake	2¾
La Rose	3¾
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines	6¾
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Porcupine T'nsite	.47
Precious Metals	‡1¾
Ray Central	1 13/16
Red Warrior	‡1⅛
South Utah M. & S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	370
Stand'd Oil Subs.	325
Stewart	.90
Tonopah	6⅞
Tonopah Ex	1⅞
Tri-Bullion	1/16
Tularosa	⅛
Yukon Gold	3⅜

BOSTON CURB Jan. 9

Name of Comp.	Last
Ahmeek	240
Bingham Mines	2½
Boston Ely	.86
Boswyocolo	.10
Cactus	.18
Calaveras	1½
Chief Cons	.64
Corbin	3½
Cortez	1⅜
Crown Reserve	2⅜
First Nat. Cop.	2⅜
Majestic	.46
Mazatan	½
Moneta Porc	.14
Nat'l Mine & Ex.	.12
Nevada-Douglas	2⅜
New Baltic	5
Oneco	2⅜
Raven Copper	.27
Rhode Island Coal	.52
San Antonio	‡3½
South Lake	5½
Trethewey	.65
Union Mines	‡½
United Verde Ext.	.90
Vulture	‡5½

LONDON Jan. 10

Name of Com.	Clg.
Camp Bird	£1 12s 0d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	2 0 0
Mexico Mines	8 2 6
Oroville	0 4 9
Stratton'sInd.	0 3 1½
Tomboy	1 3 9

‡Last quotation.